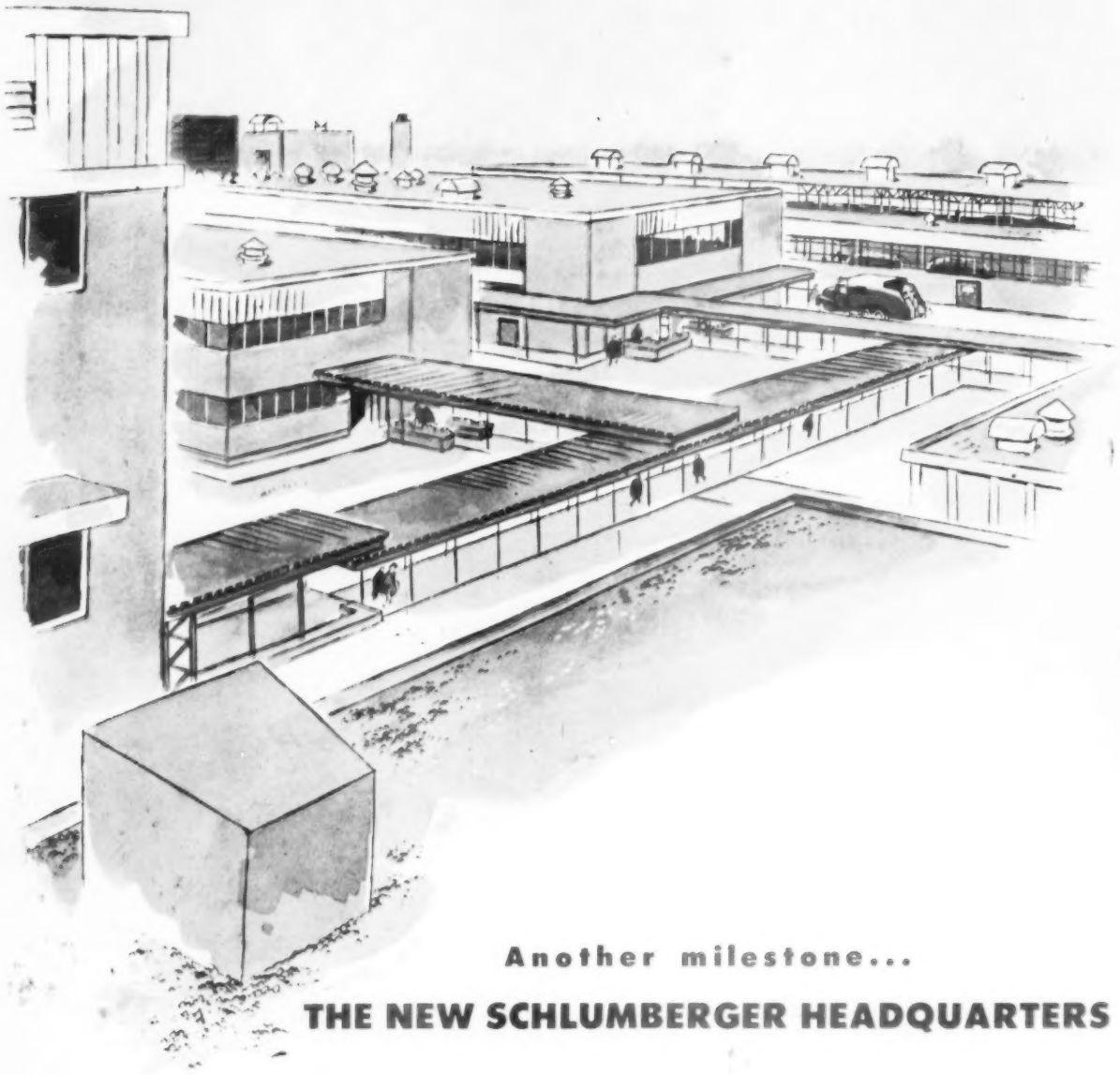
JOURNAL OF Petroleum Technology

MAY, 1953



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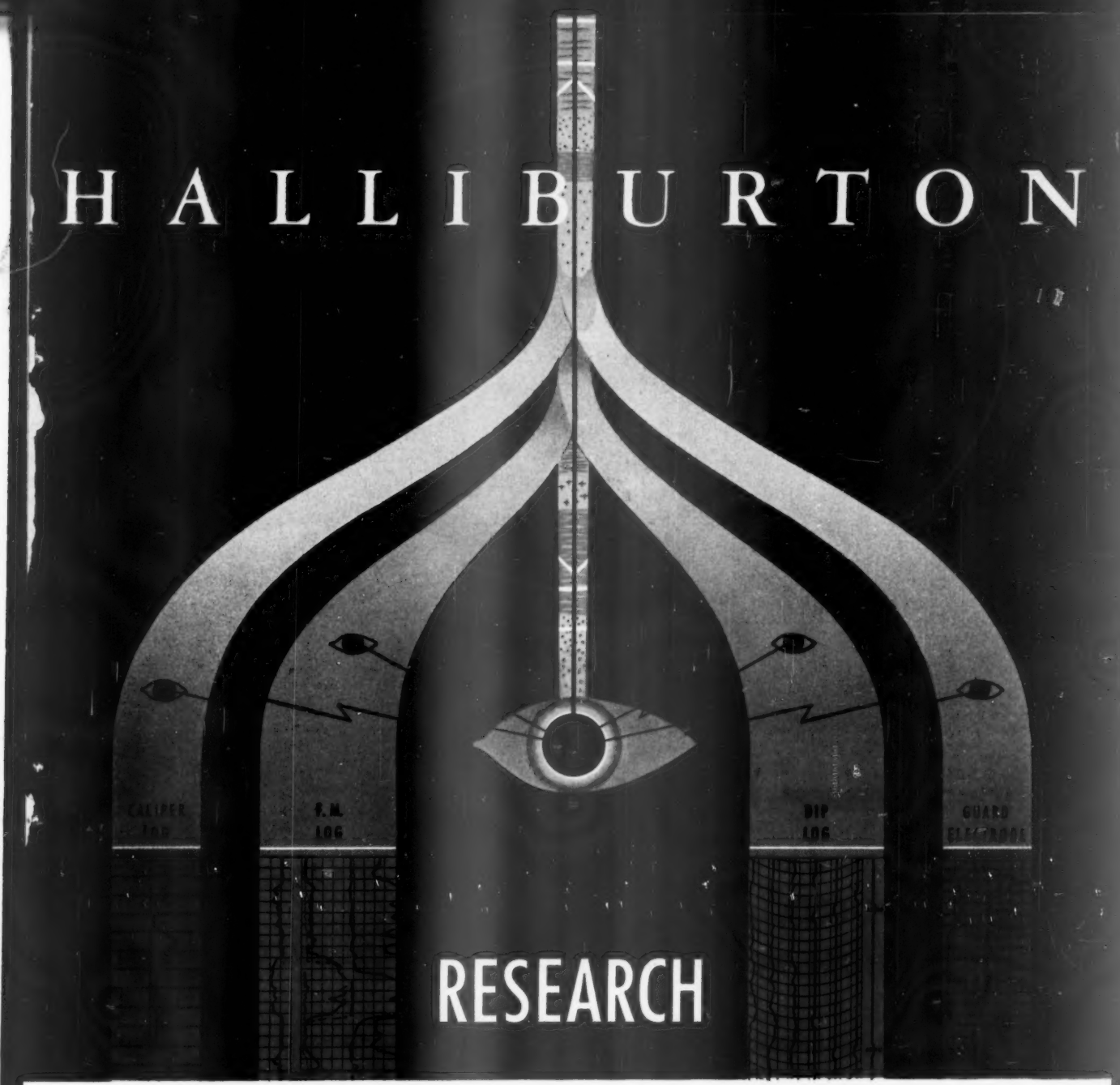
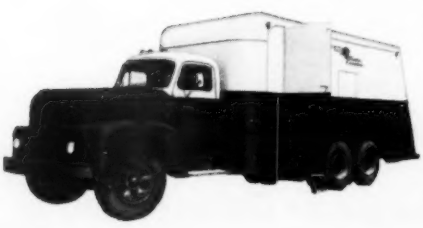


RESEARCH

The Exploring Electrode of Progress



Someday, with advancing science, finding oil may be a certainty. Even now, exploring formations electrically has given oil finding its greatest lift. The all-seeing eye of the electrode reports down-hole data with much greater detail and accuracy. One of the first to use this force was Halliburton. And to learn that interpreting electric logs was a laborious and painstaking analytical process. Highly specialized interpretive techniques were developed, which in turn demanded improved instruments. This has gone on for years and years, a most important research project in Halliburton's modern laboratories at Houston. It accounts for Halliburton's leadership in electrical well services and the recent developments of Guard Electrode Logging, FM Logging, and Dip Logging. These major contributions to modern exploration and production demonstrate decisively that research is the exploring electrode of progress.

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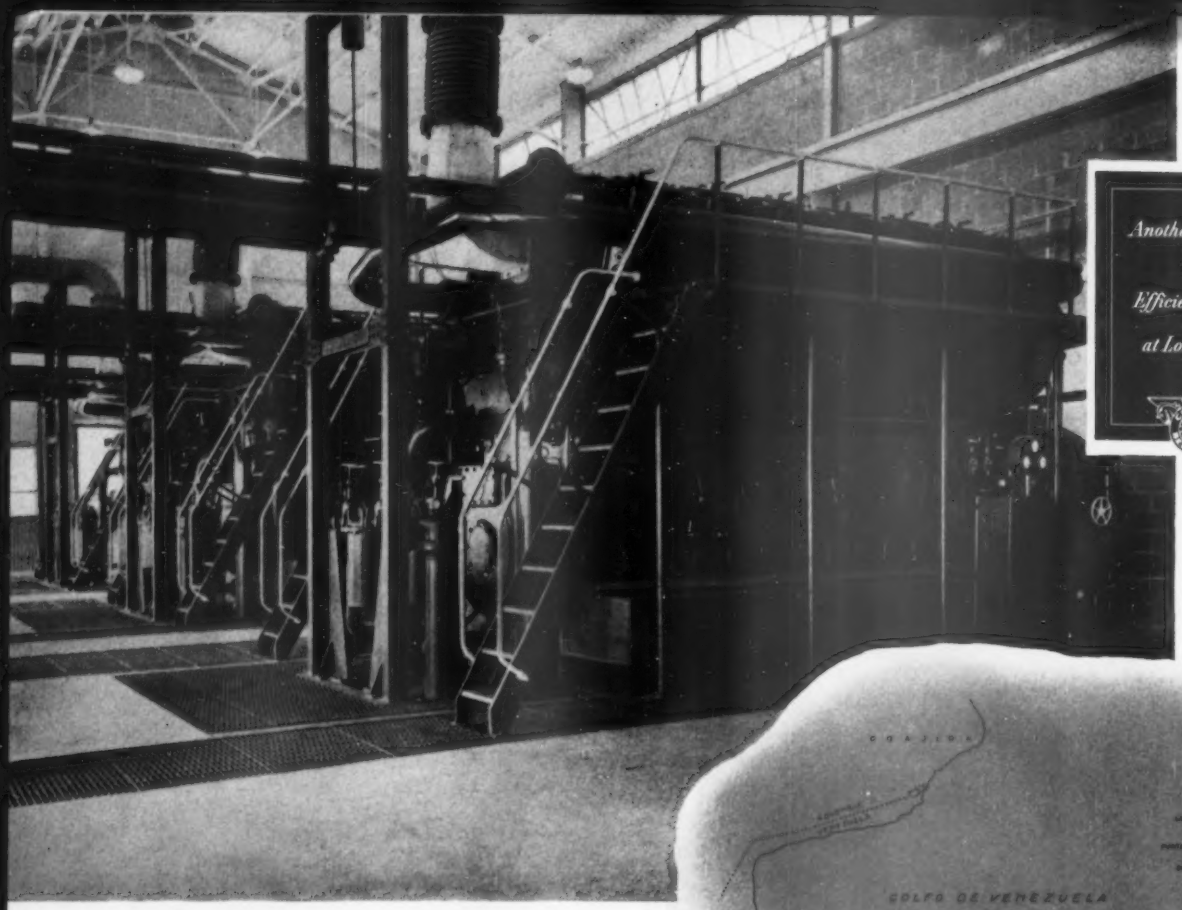

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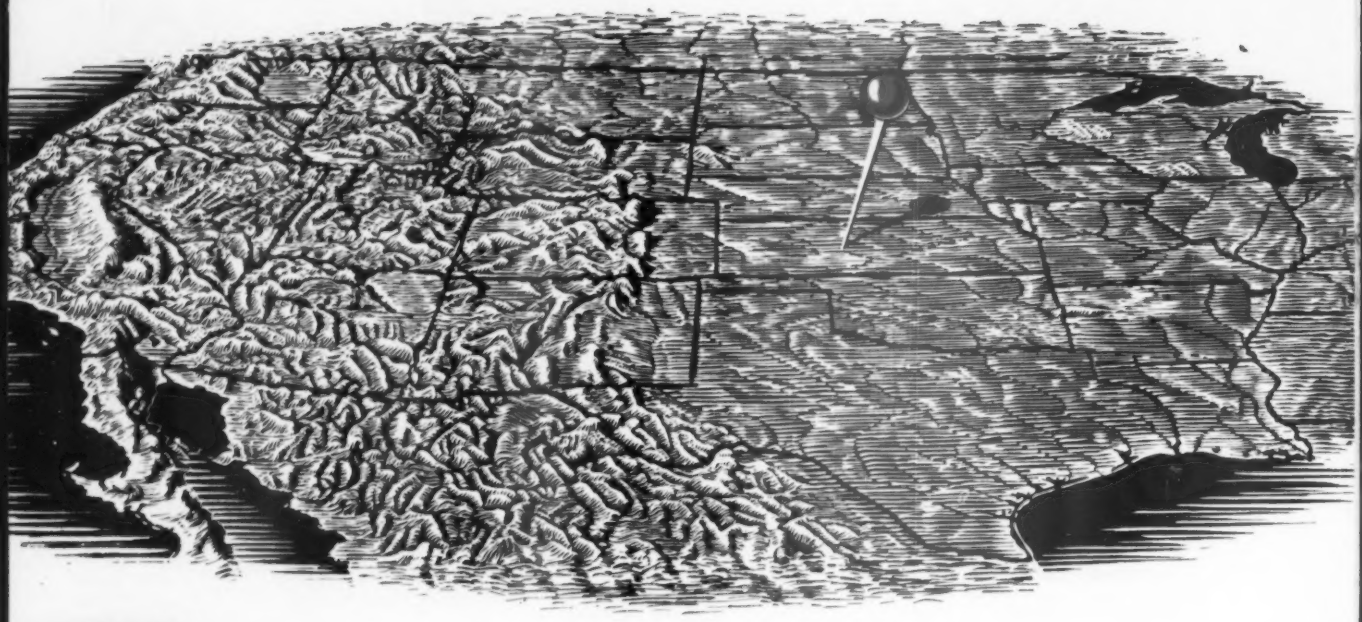

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PETROLEUM RESERVOIR ENGINEERING

JOURNAL OF
Petroleum Technology

Vol. V MAY, 1953 No. 5

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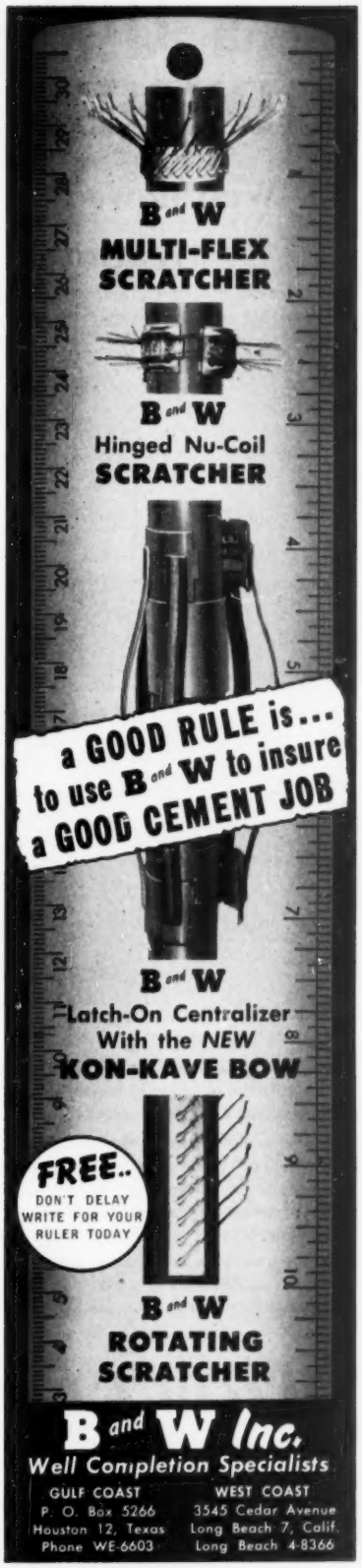
THIS MONTH'S COVER

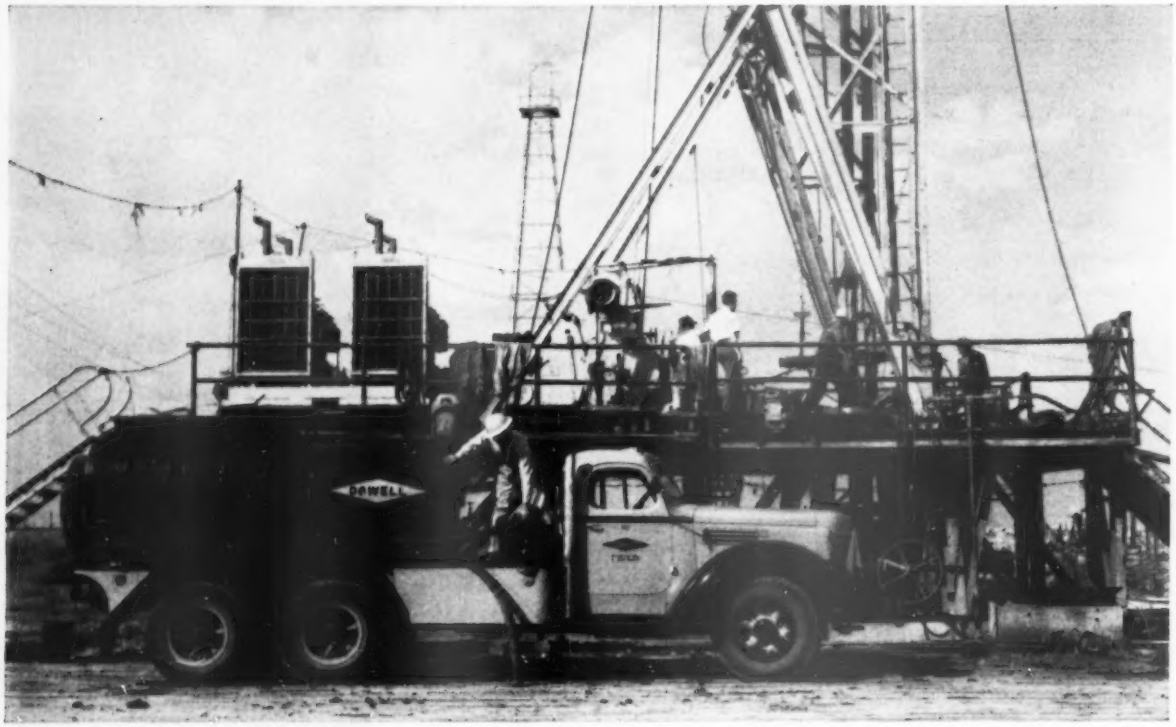
The tanker Quemado Lake rounds a bend of Gaillard Cut, in the Panama Canal. Through this strategic Western Hemisphere waterway some 20 to 30 ships pass each day. Last year 33,611,000 long tons of cargo were transported through the locks, setting a new record.

Photo reprinted from The Lamp (Standard Oil Co., N. J.)



DOWELL MUD ACID OPENED UP CRITICAL ZONE

Well flowed 25 barrels of oil per hour after chemical treatment helped solve completion problem



Production suffers when the critical area of a well is blocked. Eliminating the blocking materials so that the well can flow freely often presents a major problem to oil producers.

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This is but one example. There are many others, where Dowell Mud Acid has spelled the difference between profit and loss. Results show that cement squeeze jobs are more often successful if Mud Acid is used ahead of the cement. And many operators use it to help free stuck drill pipe.

If you'd like to know more about Dowell Mud Acid, and if you're interested in learning more about Dowell's many other oil field products and services, be sure to contact your nearest Dowell office soon. Or, write directly to Tulsa, Dept. D15.

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News Briefs

The Texas Co. refinery at Amarillo, Tex., is scheduled to be enlarged to approximately twice its present capacity. Cost of new equipment and renovation will run to several million dollars. New units, of M. W. Kellogg design, will include crude distillation, delayed coking, Orthoflow Fluid catalytic cracking, and catalytic polymerization. The enlarged refinery will be permitted to handle (based on processing Panhandle crude) 15,500 bbl of crude distillation, 3,600 bbl delayed coking, 6,000 bbl cat cracking (or 10,000 bbl with recycle). Work is scheduled to start early this summer.

* * *

Several important changes were made last month in the top management picture of Gulf Oil Corp. J. Frank Drake, after serving the past five years as chairman of the board and the previous 17 years as president, now takes a less active role as chairman of the executive committee. Sidney A. Swensrud, president since 1948, was elected chairman of the board. Wm. K. Whiteford, formerly executive vice-president, was elected president and will be the chief administrative officer.

* * *

Iraq's newest oil field (Zubair Field near Basrah) last month exported its 3 millionth ton of crude oil. The oil was loaded on a tanker at Fao, 30 miles south and across the Persian Gulf from Abadan where oil operations have been virtually at a standstill since Iran nationalized oil properties in early 1951. The Zubair Field and Fao terminal are operated by Basrah Petroleum Co. (owned by Iraq Petroleum Co. in which Anglo-Iranian Oil Co. holds a 23¾ per cent interest). Fao is connected by a 72-mile, 12-in. pipeline to the Zubair Field which was discovered in 1948. The field is currently producing at the capacity of the line and Fao's jetties — about 60,000 B/D. Construction has started on a 65-mile, 24-in. line expected to increase Zubair's output by at least 100,000 B/D by mid-1955.

* * *

The 100th anniversary of the world's first scientific examination of crude oil will be observed June 26 with a ceremony on the campus of Dartmouth College at Hanover, N. H. Some 100 industry leaders, businessmen and academicians will witness the unveiling of a memorial tablet at Crosby Hall where the initial examination took place in 1853. The report of the examination by Dartmouth professors Dr. Dixi Crosby and Oliver B. Hubbard that "this strange, black liquid contained useful and potentially valuable properties," led to the formation of the world's first oil company and eventually to the drilling of the world's first commercial oil well at Titusville, Pa.

* * *

One of the world's leading pioneers in fuel combustion is currently in England to study industries there planning to utilize Saudi Arabia's by-product refinery gas that is scheduled to be piped some 2,500 miles to England. Ernest H. Peabody, New York engineering founder and president of Peabody Engineering Corp., is helping to analyze and solve problems arising from a contemplated large scale industrial conversion program that would utilize gas as well as the present oil and coal.

* * *

Texas Railroad Commission Chairman Ernest O. Thompson told API Division of Marketing members in Dallas early this month that "industrial leadership, not legislation, is the right way to solve the impasse between foreign oil imports and U. S. domestic production." Thompson claimed that the "battle" pits imports against oil and gas conservation measures and "leadership . . . must find a happy medium on import reduction so that world trade (can) be maintained in oil and yet not flood out domestic crude from our home markets." Thompson predicted that by 1975 America would be using 12 to 14 million bbl of oil per day.

* * *

The National Bureau of Standards says that its Circular 410 (National Standard Petroleum Oil Tables) will be withdrawn from circulation July 1 unless "cogent reasons for retaining the circular" are presented by interested parties. Reason is given that the same information is now incorporated in the ASTM-IP Petroleum Measurement Tables recently issued by the American Society for Testing Materials and the Institute of Petroleum (Great Britain).

* * *

R. E. Nelson, Jr., director of supply and transportation for the Petroleum Administration for Defense, said last month that despite a relaxing in the tension of world crisis, PAD is still needed as an agency to help mobilize petroleum supplies. Said Nelson: "Most materials controls can be dropped June 30. Only direct defense needs and the needs of the atomic-energy program are expected to continue to hold priorities. The oil and gas industries, along with all the other defense-supporting industries, will have to take their competitive chances in an open market come July 1." He predicted that by June 30, PAD will be down to a "skeleton organization." Chief reason for continuing PAD, according to Nelson, is "the continuing shortage of high-octane aviation gasoline."

* * *

Meanwhile, the API announced that the domestic consumption of gasoline in 1952 rose to an all-time peak of 46.4 billion gal. This figure is an increase of 2.5 billion gal over 1951 consumption. Chief consuming states were California, 4.4 billion gal; Texas, 3.9 billion gal; New York, 2.9 billion gal; and Illinois, Pennsylvania and Ohio, 2.4 billion gal.

* * *

The world's largest drilling barge, a floating structure four stories high with equipment designed for drilling to 20,000 ft, is now on location in Louisiana waters. The barge was built for The Superior Oil Co. Its power plant totals more than 5,000 horsepower, its derrick rises 192 ft above the derrick floor and its gin pole is more than 240 ft above the main deck footings. The submersible barge is 237 ft long, 54 ft wide and has a hull depth of 14 ft with a minimum draft of 4 ft 6 in. The barge, which has a slot 108 ft long, is intended for working in water up to 12 ft deep. ★ ★ ★

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The improved McCullough M-3 Burrless Bullet Perforator, the hardest shooting gun perforator in the world, features an increase of 25% in penetration over former McCullough bullet type perforators. The M-3 will outshoot any comparable size bullet or jet gun through one string of casing into soft or medium hard formation. McCullough M-3 Perforators, Burrless Bullets and actual penetration samples will be on display.

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The only one-piece, drillable, all metal, explosion-expansion bridge plug. Drills out easily—no moving nor hardened parts to impede drilling out. Resists corrosion and electrolysis. Saves rig time in running, locating and setting. Plugs in open hole in hard formations. Assures a positive seal under the heaviest loads. Special display will permit you to weigh yourself and pressure test plug at the same time.

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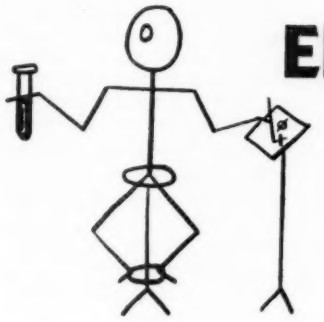

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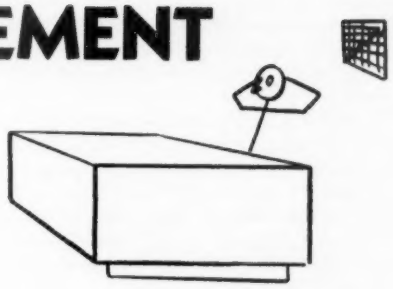

By Douglas Watson

McKinsey and Co.

How is a good engineer turned into a good manager?

There are indications on all sides that this country is becoming more and more dependent upon engineering skills and talents. It is not enough to design and place complex engineering works into operation; they require management, and they frequently require engineers as managers. This need for engineers as managers has grown substantially in the last 10 years. There is every indication that this growth will continue.

There is evidence that the engineers themselves are concerned about becoming managers. Many good engineers are uncomfortable in administrative positions, and want to improve their status. Others, seeing the rewards achieved by successful managers, are striving to become "management."

The concern that engineers generally have for this problem implies two conclusions:

1. Engineers are different from other people, and
2. "Management" is something that does not respond to engineering logic.

Experience throughout the country in both large and small industrial organizations shows that both of these conclusions are true to a certain degree. Generally, engineers seem to stand apart from others in the management field, and although there have been certain notable and outstanding exceptions, engineers typically have had a difficult time adapting themselves to the management scheme.

However, there are other factors. First, "management" is not a science; in fact, a study of its successful practitioners indicates that it is an art and a difficult one at that. Second, non-engineers also have real problems in being managers. Finally, non-engineering managements, realizing that these conditions exist, have developed techniques to correct them.

The Engineering Personality

A look at the cross section of the pre-educational experiences of trained engineers will help give an insight into the engineering personality. Usually engineers have been classified as being mechanically bent or as being interested in "things." It is not infrequent, for example, to find that men in the electrical engineering field have been ham radio enthusiasts, or that successful mechanical engineers have been pretty good mechanics. As a corollary to this, they seem to have gotten most of their enjoyment from working with things or inanimate objects. While it is bad to generalize, it is the unusual engineer who is normally or naturally gregarious, except around other engineers. This situation is rationalized by saying: "We're too busy for that sort of thing."

Professional Education

To assist in defining the engineering personality, it is worth while to look at the educational steps through which this engineering personality has been taken. Typically the professional engineering education stresses the objective approach in basic mathematics, mechanics, and other sciences. After several years of this "general" background engineers tend to specialize further. The result of this education is that engineers emerge as graduates having *logic* as their long suit.

This logic is a mathematical, engineering logic. However, engineers do not have much understanding of the emotional or the "logical" action of people. As a result, the graduate engineer can really think, but frequently has a difficult time getting the message over to others. He does not appreciate

that others do not think as logically as he does. He believes that "it isn't really necessary to understand others, for if it can be demonstrated that *A* plus *B* equals *C*, everyone will accept that as 'fact'."

However, the psychologists are now showing that it is the rare individual who will respond to the logic treatment; that is, logic in the engineering sense of the word.

Experience

After several years of specialized engineering training, the youthful engineer emerges and takes a job — a job as a trainee or as a junior engineer, but as an *engineer*. This job can consist of a couple of years on a drawing board, with a field crew, or as an inside engineer. Having demonstrated his ability *to think*, the young engineer frequently gets promoted. He is concerned mainly with technical work and with the solving of engineering problems, but not with the reaction of people. At this point he still treats *logic* as the way to get action.

As the engineer works his way up the ladder, his next position will probably be that of a senior engineer. Here he will be responsible for working with an engineering group, frequently checking the results of that group's activities. Generally he will not have overall administrative supervision, nor will he be involved with the heavily loaded problems of management. After some time as a senior engineer, he may be given more responsibility.

He may emerge as a manager. He may not have much to manage, but he will be a manager nevertheless. And here he has to get *others* to work for *him*. A lot of good men are lost on this frontier.

If the young engineer-manager is successful, and usually he is successful to the extent that he can swim in a sink-or-swim situation, or if he possesses some advanced technical knowledge, or if the enterprise is growing rapidly and he is pushed into a growing situation, he soon will get promoted again. And then he is managing managers.

He has arrived now at the point where he must get things done through other people. Now the engineer becomes an *administrator*. He usually has difficulties in assuming these responsibilities. His reaction to this new situation typically is: "Why do I have to do so much? In my day we knew what we were doing. These young engineers just are not as good as we were."

What Is the Problem?

Actually, the younger generation of engineers is probably better trained than the older. From the starting rates being offered on the completion of their schooling, some people suspect they are being a bit spoiled, but basically, they have been a serious-minded lot in school. The academic training that has been offered them has been excellent.

It is the older generation's point of view that has changed. The very practices that were accepted by engineers a few years ago now present a problem. There may be some solace in the fact that it is not a unique problem. All industry is facing it today.

What actually has happened is that subordinates are not being trained as well as they used to be. Man-to-man coaching probably comprises 80 per cent of all management training. With the ever increasing demand for engineering time and talent, this man-to-man coaching has suffered. As sufficient engineers were not available during the war period, training is now needed more than ever before. The situation is becoming extremely serious.

What can be done about it? The problems of preparing engineers can be dealt with both on an individual and on an organizational basis.

How the Problem Can Be Solved

As has been indicated, the problem is not a unique one. Preparation of people for management is a popular subject, and it is something with which all industry is now concerned, and should be approached in terms of the engineer and the engineering profession. From the standpoint of the individual, the objectives should be (1) to progress in status and get better jobs, (2) to obtain greater awards in terms of recognition and financial status, and (3) to be happier in the management situation. This last item is particularly important.

The company has a lot at stake, too. A proper program that accomplishes the individual objectives stated above will result in improved effectiveness in the corporate organization. It will also help build a reservoir of qualified people so that the company can expand and take care of the normal growth. Finally, it will improve morale. This means that the company can attract and hold the better people. More and more companies are finding that these objectives are important ones. Their attainment has an important bearing on the success or failure of the corporate enterprise.

Can this be approached as an engineering problem?

As an engineering problem, a step-by-step plan should be developed to arrive at a practical answer and to improve the current situation. While it is possible for the engineer to work out a program for self-improvement himself, the more formal company-stimulated approach to this problem will be discussed here.

A Plan for Developing Engineers as Managers

There are many executive development plans in action. Looking at the successful ones, the conclusion can be drawn that there are two important prerequisites to a plan for executive development.

The first is that the approach must be *down to earth*. This problem must be approached with a full recognition of all the factors that will influence its success or failure. Considering the development of engineers as managers, the difference in basic attitudes between engineers and other management people must be recognized. Peter Drucker, in a recent issue of the *Harvard Business Review*, discussed some of these differences and concluded that there are substantial differences in basic attitudes between the professional employee and other members of the management team.

To make the plan effective for developing engineers, these differences in basic attitudes should be considered and plans should be built around them.

The second important prerequisite to a successful plan is that it must be practical. The best approach to this is to find out what has worked well in the past and to do more of it. As simple as this sounds, many plans for developing executives have been academic in their approach and have tended to ignore the things that actually work well in the business situation.

In addition to these two important prerequisites, there is a third general condition that must prevail if any plan is to be an overall success. The proper climate within the organization must be established and the proper top-management appreciation of the problem must be obtained. An organized approach

to developing managers is necessary if success is to be had on a broad front. Unfortunately, some of the plans for executive development appear to have been undertaken by companies more on the basis of "this is a new management technique, let's try it" than on the basis of a real desire to improve the caliber of executive talent. As Miles Mace has said, there is an almost inverse relationship between the degree of publicity given to formal executive development programs and their actual success in operation.

It is a serious matter for a company to undertake an organized plan for the development of executives and administrators. Top-management support throughout the organization is necessary. Further, it needs enthusiastic participation by the managers and executives themselves. It needs constancy of effort so that the program will not falter.

What is involved in such a program? Briefly, such a program should be designed for the company situation and would include these steps:

1. Develop a good company organization plan.
2. Determine the management and administrative needs.
3. Find out what the key positions really require.
4. Take an inventory to find out how well these requirements are being met.
5. Plan individual programs for individual development, either on a company-wide basis or on a selective basis.

It is this latter phase which causes concern. Assuming these other steps are undertaken, what can the engineer do himself? How can the superior help his subordinate to become a better manager, a better executive, and a better administrator? What can an executive development plan do to help?

How the Engineer Can Learn to Manage

For the individual engineer to benefit from such a company program, he should recognize two things:

1. There are more failures, in a business sense, because of a lack of administrative ability than because of a lack of technical ability, and
2. The engineer who wants to become a manager must want to manage.

Actually, as the engineer is increasingly successful as a manager, he will be doing less and less creative engineering. If this will not be personally satisfying, then the individual should choose the engineering route to happiness. It is presumed here that the necessary individual desire and drive to manage does exist.

In general, there are four ways that the individual can develop his administrative abilities. Although these are most easily and successfully followed where a company executive development plan exists, much can be accomplished by the individual, even if there is no formal program. These four ways are:

1. He can get the most out of his job.
2. He can rotate jobs.
3. He can participate in a "program."
4. He can be developed by his superior.

The effectiveness of these four points depends largely upon the man's recognition of their importance in his career development.

A resourceful individual working with his superior can frequently find ways to modify the duties of his own position so that he can get added responsibility and experience. This can be done by:

1. Undertaking special work assignments, particularly those which will bring the subordinate into work contact with other executives.
2. Participating in problem-solving conferences which will give the subordinate a chance to participate in decisions.
3. Assuming more responsibility by accepting the delegation of specific duties from his superior.

Job rotation is a normal part of every executive's development. Usually, however, it is unsystematized and unplanned. Turnover in organization, expansions of certain departments, and retirements all too frequently occur on an unplanned basis. However, there are few companies in which a purposeful job rotation cannot become a major development method.

Through proper timing, and with adequate consideration for the individual, much can be done by planned job rotation. The man in the new job is compelled to adjust to new problems and new people. He develops his ability to think effectively and to deal with human relations problems. This is a most important aspect of his development.

In some cases, of course, it will be difficult to rotate a man to an operating job. However, there are ways around this. Under these conditions, staff jobs can be used or special "assistant to" positions created for planned experience. If this can be done without attaching the "crown prince" stigma to the person who is rotating, it is an excellent development medium.

The program approach to executive development is a more formal one and one that requires greater preparation and organization to be effective. The business press has been greatly attracted recently to programs for executive development. In brief, some of the more important program techniques applied in developing executives are:

1. *Management boards:* Here, junior executives are given the opportunity to participate in management decisions outside the scope of their normal positions. As a result, they come to appreciate the many factors that must be considered in arriving at practical business decisions.
2. *Role playing:* In some cases, the use of psycho-dramas is an effective development technique. Under the help of a training director, individuals act out certain administrative situations, discuss the problems the situations pose, and attempt solutions to them.
3. *Group study:* Specific administrative problems can be posed and solutions sought through group study and conference participation. This is also a helpful technique in broadening executive talent and improving administrative ability. This particular approach, however, requires a substantial amount of preparation and must be well organized if it is to be most effective.
4. *Guided individual programs:* Here, specific training courses are outlined in terms of positions, regional locations, and similar experiences, and a definite program of progression is set up for the individual.
5. *The school approach:* Frequently the solution to the problem of developing managers is sought through formal schooling programs. A company or individual may decide to supplement these other development methods with formal training, either organized within the company on a conference basis, or on the outside. Examples of this are the special courses in local business schools and the Advanced Management Program at the Harvard Graduate School or its counterpart at Stanford University.
6. *Conference attendance:* Society meetings demonstrate still another technique of executive development. Urge attendance at conferences devoted to the discussion of technical problems and problems outside the employee's specific technical field. The individual, through attending such conferences, has the opportunity to meet other executives, other

successful practitioners in the field, and to learn from their experience ways in which management problems can be solved

It is still true that human beings learn by watching and by imitation. This, then, presents a double opportunity to the supervisor in helping him develop the people under him. Good administration makes man-to-man coaching easier. Having a successful "boss" makes it easier for the subordinate to learn the right way to do things.

But why should the supervisor help his people? He is so concerned with his own pressing problems that he finds it hard to devote sufficient time to solve them.

One of the reasons why the supervisor's job is so hard is that his subordinates are untrained. Therefore, the time spent helping them will return dividends. In addition, there are few quicker ways to grow in an organization, to reap the benefits of promotion, than by "pushing yourself out of your own job." A reservoir of competent people under you brings your promotion that much nearer.

What, then, can a supervisor do? He can make his job easier, set a better example, and help train his subordinates by:

1. *Defining the job to be done:* It is important that the subordinates have a clear understanding of what is expected of them. No man can give his best performance when he does not understand what is expected of him.
2. *Improving delegation:* Since every executive must get things done through other people, delegation is an essential part of an executive's job. One of the prime complaints of subordinates today is that their supervisors will not delegate to a sufficient extent. When they do, frequently there is too much control by the superior. Often the delegator will go into detail of how the job is to be done as well as what the job to be done is. In addition to the help it gives subordinates, the executive who does a good job of delegation actually creates time for himself.
3. *Directing decisively:* The great complaint of many subordinates is indecision, or failure of their superiors to face up to the need for decision. Actually, there are many times when inferior decision is better than none at all. A number of prominent successes have been quoted as saying: "You need to be right only 51 per cent of the time. However, the effective executive does not reach snap judgments or make "off-the-cuff" decisions. On the other hand, he does not keep his subordinates "up in the air." He makes his decisions promptly or tells his subordinates why he cannot decide now and then when they can expect a decision.
4. *Making decision based on fact:* Unless the approach to decision-making is fact founded, subordinates must necessarily try to guess the emotional attitudes and experienced biases of their superiors. There are three good reasons why decisions should be based on fact. First, it is much easier to make a decision on the basis of fact than on hunch or personal opinion. Second, decisions based on fact are much more likely to be good ones, and third, decisions based on fact are much more defensible. As industry becomes more complex, the need for the factual approach is naturally emphasized.
5. *Being open-minded:* One of the best ways to encourage subordinates to bring in ideas is to be open-minded. It helps them grow, and it increases the possibility that worth-while ideas will come to the attention of the management. It is good practice to see that a new idea is greeted with at least a "maybe" rather than with an outright "no." It is also good practice periodically to agree with a new idea, even though the idea may not be great, if there is no strong reason for disagreeing with it. Ideas are fragile things. Great ones necessarily are too few. As the probability of more ideas is increased, the probability of more great ones is increased. So any step in the direction of encouraging subordinates to bring in more ideas is certainly worth while.
6. *Sorting out the important:* American industry is made up of too many executives who are loaded with trivial details. The unfortunate thing is that in too many cases, these men do not know it. They have been dealing with the unimportant so long that they have lost their ability to differentiate. It is impossible to undertake a management job if this ability to distinguish the important from the unimportant is lacking.
7. *Understanding:* An essential ingredient in developing men is to be able to understand the other fellow's viewpoint. Then understanding can only be developed with some patience and a great deal of tolerance. A good executive knows he cannot gain the respect of subordinates unless he does set high standards and hold his subordinates to them.
8. *Keeping a good balance:* Coupled with energy, enthusiasm, and drive, a good sense of humor and a good degree of emotional stability are real assets to the executive and potential executive. The greater the executive, the less likely he is to take himself too seriously. That does not mean that he is not serious, but that he has a lightness of touch and informality of manner that seem to have their origin in a sense of humor. It is hard to describe what is meant by emotional stability, but this is a useful label for a phase of personal make-up that has to do with maturity, stability, and solidarity of emotions that keep the individual from "going to pieces" when he is under pressure. The emotionally stable person does not get unduly upset when the going is rough and there are many important things to do at the same time. This too, has an important effect on the growth of the men under him.

It is unfortunately true that we cannot learn to manage by taking a course, or swallowing a pill. This fact in itself, however, makes the job of developing managers an interesting one. If the job were easy, there would be no incentive for the individual to grow. As has been indicated, the basis for success or failure of a management training or development program lies in the individual.

Everyone has an opportunity to learn from his present job. Most can create the opportunity to get experience through other jobs. Even if there are not formally organized development programs within a given company, opportunities exist for outside training through developing study groups and the like. And, finally, everyone in his superior-subordinate relationships has the opportunity to train others and train himself in the process.

Executive development is a long-range program. It is one that taxes the abilities and the determination of all members of the top management group of the company. For years, the benefits may seem intangible. Results may not be seen quickly enough. Under these conditions, enthusiasms may flag. Thus, there is the great risk that companies will approach this problem of developing executives the way most people do setting-up exercises. They start off enthusiastically, but soon, one thing or another interferes, and they get too busy, then gradually neglect them.

In the meantime, however, those progressive and profit-conscious companies that have started such development programs and have then followed them through, have built a firm foundation for corporate security and increased profits in the highly competitive years to come. ★ ★ ★

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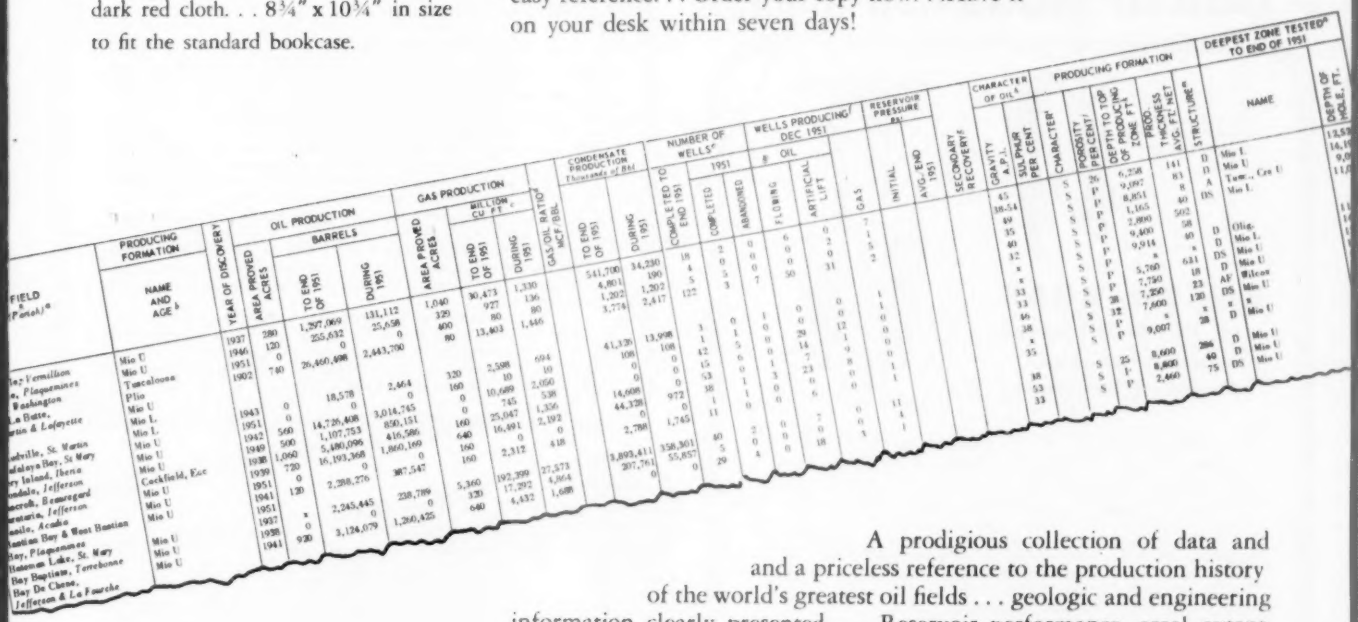

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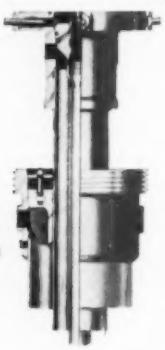
View of Flange installed showing packing arrangement.



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Type "UPS-DF" Heads combine all the "UPS" advantages with an additional important feature–*Demountable Flanges that can be salvaged after the drilling operations for use on other installations.*

The body, packing and slips of this design are the same as standard "UPS" Heads to provide all the important "UPS" advantages outlined at left. However, the flange is attached to the main body by means of a square thread so that it can be readily removed when drilling operations are completed.

During drilling, the flange is installed on the Head to provide means for attaching standard pressure control. A unique packing arrangement–having important advantages over the conventional ring-groove design–prevents leakage between the flanges and is so placed that the square thread is not exposed to casing pressure.

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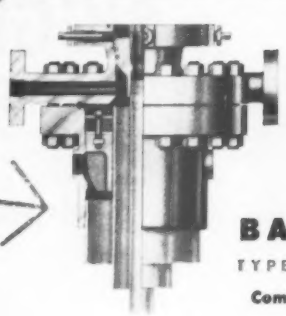
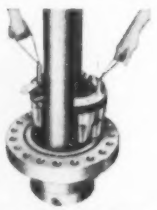
Available in a complete range of sizes and designs, Type "UPS-DF" equipment is the latest in a long string of Baash-Ross Landing and Casing Head advancements. *Be sure to investigate the economies this equipment can make for you!*





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Type "UPS" Heads–a new Baash-Ross development –have the Packing Element and Slips unitized into a *single* hinged assembly that simply w-r-a-p-s around the casing and locks in place with one bolt. As the weight of the casing is placed on the slips, they *automatically* equalize themselves within the bowl to assure exact centering of the casing as well as a uniform grip around the *entire circumference* of the pipe. A few quick turns of a wrench then expands the packing element for a pressure-tight seal.

"UPS" ADVANTAGES INCLUDE . . . (1) No space wasted by threads, grooves or other packer-retaining devices–therefore overall height is reduced to a minimum . . . (2) Elimination of threads, grooves, etc., means a smooth bowl–nothing to become damaged during drilling operations, no need for protective sleeves . . . (3) Since all the slip segments are unitized together, none can set higher or lower than the rest–no risk of crimping the casing, no danger of an unequal grip that may fail in service . . . (4) Slips are set and packing is tightened around casing without stripping and without first cutting the casing. Simplifies installation–saves time!

"UPS" Heads also incorporate the unique Baash-Ross weld-testing feature which permits simultaneously testing the pressure-tightness of *both* casing welds with a gauge and hand pump as part of the installation procedure–or any time later. Any leaks discovered during the life of the well can be quickly sealed off by injecting plastic pack material.

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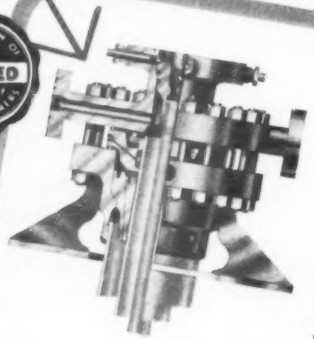

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TYPE "X" ADVANTAGES INCLUDE . . . (1) No grooves or threads in bowl to become damaged during drilling operations . . . (2) One-piece Packing Assembly mounts between flanges for maximum space saving . . . (3) Unitized Slips assure uniform slip pressure . . . (4) Packing Assembly and casing weld are so designed that seal around casing can be checked at any time during life of the well, and repaired with plastic material *without even breaking connections* . . . (5) Series ratings and flange sizes can be easily changed in the Head.

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Technical Note 161

VAPORIZATION OF HYDROCARBONS FROM AN UNCONSOLIDATED SAND

CHARLES W. OXFORD, UNIVERSITY OF ARKANSAS, FAYETTEVILLE, ARK., AND **R. L. HUNTINGTON,** MEMBER AIME, UNIVERSITY OF OKLAHOMA, NORMAN, OKLA.

During the past 20 years (1932-1952), many condensate reservoirs have been discovered in the United States, particularly in the Gulf Coast region. Most of these reservoirs have been produced by a combination of gas cycling and slow pressure depletion in order to recover the liquefiable components from the single-phase fluids originally existing within the reservoirs.

Although a record of the composition of the produced fluids has been kept on some of these reservoirs, very little laboratory work has been done on small scale replicas so as to obtain some idea of the effect of such variables as fluid flow with-

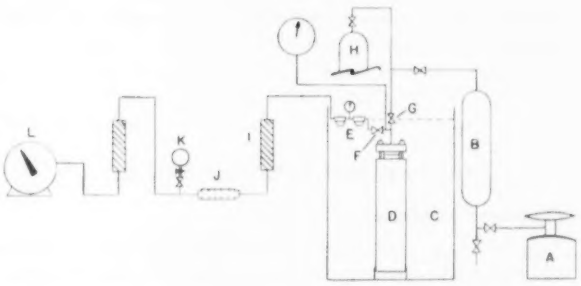

FIG. 2 — DIAGRAM OF PRESSURE DEPLETION APPARATUS.

[1]References given at end of paper.

Manuscript received in the Petroleum Branch office April 17, 1952. Paper presented at the Petroleum Branch Fall Meeting in Houston, Tex., Oct. 1-3, 1952. This note is abstracted from a thesis submitted by Oxford in partial fulfillment of requirements for the PhD degree in chemical engineering at the University of Oklahoma.

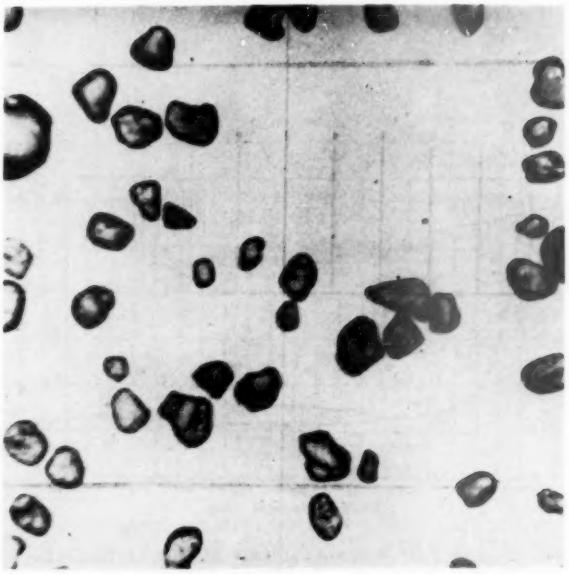

FIG. 1 — MICRO-PHOTOGRAPH OF WILCOX SAND (300 MAGNIFICATIONS).

drawal and cycling rates, pressure, temperature, percentage of liquid hydrocarbon and water saturation within the reservoir. Weinaug and Cordell[1] have shown experimentally that condensates can be revaporized within a sand reservoir; however, they studied only the effect of fluid withdrawal rate.

In this investigation the above mentioned variables were studied experimentally in small scale reservoirs both in the case of vaporization of condensate by batchwise pressure depletion and for the constant pressure cycling or "sweep method." In each instance, nitrogen was used as the vaporizing gas, and n-hexane, n-heptane, and condensate were the liquids used to partially saturate the sand.

The normal hexane and heptane used in this investigation were Phillips Petroleum Co.'s pure grade hydrocarbons containing a minimum of 99 mole per cent of the named compound. The brine used in one portion of the study was obtained from a Wilcox Sand well at the 4th and Geary Streets location of Phillips Petroleum Co. in Oklahoma City, Okla. It contained approximately 195,000 ppm of total solids. The condensate was obtained from the Gwinville, Miss., Field, and had the following properties: API gravity, 56.1 at 60°F; Reid vapor pressure, 2.4 psi at 100°F; ASTM distillation range, 110°F to 500°F. The vaporizing gas was commercial nitrogen, and its molecular weight, determined gravimetrically, was 27.93.

Wilcox sand was obtained from an outcrop near Ada, Okla. A photograph is shown in Fig. 1. It had a porosity of 32.8 per

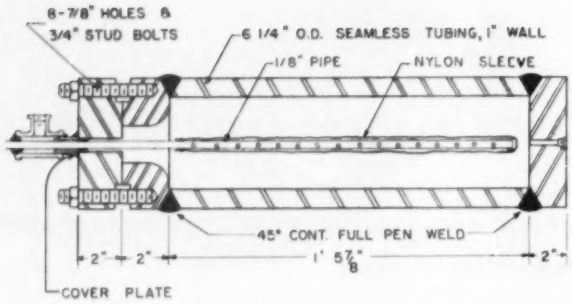

FIG. 3 — SECTION SKETCH OF RESERVOIR BOMB.

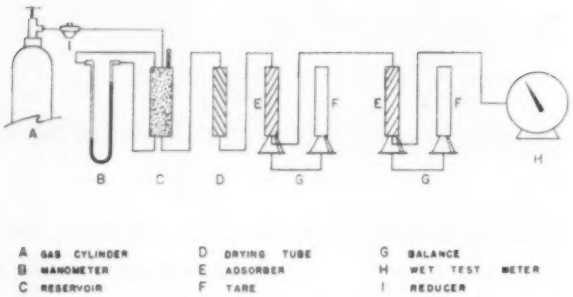

FIG. 4 — DIAGRAM OF ATMOSPHERIC SWEEP APPARATUS.

cent, a permeability of 1.0 darcy, and was found to be preferentially wetted by water or brine in the presence of hydrocarbons at atmospheric pressure.

EXPERIMENTAL PROCEDURE

Pressure Depletion Studies

Fig. 2 shows a diagram of the apparatus used to study vaporization by pressure depletion. The reservoir bomb was packed with the partially saturated sand at a temperature below 45°F. With the apparatus assembled as shown in Fig. 2, gas from cylinder "H" was flowed into the reservoir bomb and into the auxiliary bomb, "B," after displacing the water from it. When full cylinder pressure was applied to the bombs, the cylinder valve was closed, and water was pumped into the bottom of bomb "B" until the desired pressure was obtained.

The bomb was allowed to remain in the constant temperature bath for 24 hours before the gas was bled off. Valve "F" was opened and the reducers so adjusted to give the desired flow rate. Samples of gas were withdrawn at "K" by opening the cocks on evacuated bulbs. The density of the samples was then determined gravimetrically.

Constant Pressure Flow Studies

A diagram of the apparatus used in the constant pressure flow studies is shown in Fig. 4. Hydrocarbon was mixed with dried sand and put into the reservoir, "C." When the temperature of the sand was within 5°F of atmospheric temperature, the gas from the cylinder was flowed through the system. The quantity of hydrocarbon vaporized was determined by the change in weight of the absorbers.

CORRELATION OF DATA

Densities of the gas samples taken during the pressure depletion runs were converted to specific gravities at 60°F and 1 atmosphere. In addition, the number of barrels of hydrocarbon per million standard cubic feet of nitrogen was calculated from the densities. Plots of gravity and barrels of hydrocarbons *vs* reservoir pressure are shown in Figs. 5, 6, 7, 8, and 9. In addition, Figs. 5, 6, 7 and 8 present theoretical curves based upon the familiar thermodynamic expressions plotted as the ratio of moles of hydrocarbon, n_c, to the total moles of gas, n_T, per cubic foot of mixture.

$$ln\left(\frac{f_n}{P_n}\right) = \int_0^{P_n} (Z-1)\, d\ln P \quad . \quad . \quad (1)$$

$$\text{and} \int_{f_n}^{f_P} d\ln f = \frac{1}{R_T}\int_{P_n}^{P} V_L\, dP \quad . \quad . \quad . \quad (2)$$

where

f_n = fugacity at normal vapor pressure
f_P = fugacity at total pressure
P_n = normal vapor pressure at temperature T
P = total pressure
R = gas constant
T = temperature
V_L = molal volume of the liquid at temperature T
Z = compressibility factor

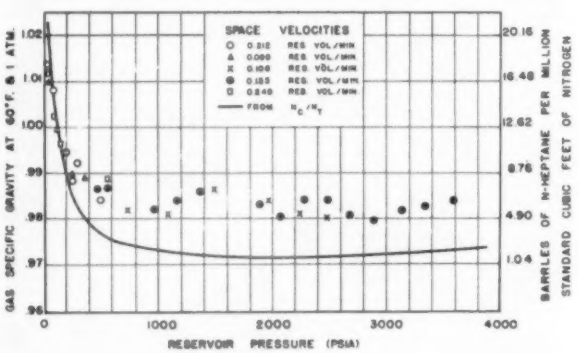

FIG. 5 — EFFECT OF WITHDRAWAL RATE ON THE VAPORIZATION OF N-HEPTANE WITH NITROGEN BY PRESSURE DEPLETION AT 100°F. BOMB PACKED WITH SAND, 5 PER CENT SATURATION WITH LIQUID N-HEPTANE AT START OF RUN.

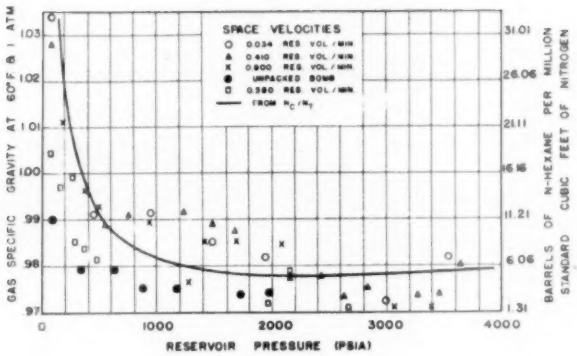
SPACE VELOCITIES
GAS SPECIFIC GRAVITY AT 60°F & 1 ATM
BARRELS OF N-HEXANE PER MILLION STANDARD CUBIC FEET OF NITROGEN
RESERVOIR PRESSURE (PSIA)

FIG. 6 — EFFECT OF RATE OF WITHDRAWAL AND PRESENCE OF SAND ON VAPORIZATION OF N-HEXANE WITH NITROGEN AT 100°F BY PRESSURE DEPLETION, 5 PER CENT SATURATION OF N-HEXANE IN SAND PACKED BOMB.

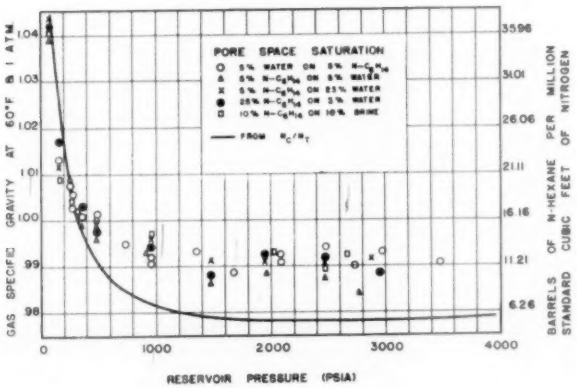
PORE SPACE SATURATION
GAS SPECIFIC GRAVITY AT 60°F & 1 ATM
BARRELS OF N-HEXANE PER MILLION STANDARD CUBIC FEET OF NITROGEN
RESERVOIR PRESSURE (PSIA)

FIG. 7 — EFFECT OF VARIOUS PERCENTAGES OF WATER AND BRINE ON VAPORIZATION OF N-HEXANE WITH NITROGEN AT 100°F BY PRESSURE DEPLETION. SPACE VELOCITY, 0.67 RESERVOIR VOLUMES PER MINUTE.

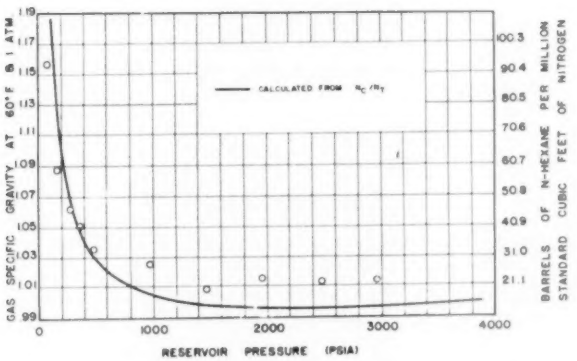
GAS SPECIFIC GRAVITY AT 60°F & 1 ATM
BARRELS OF N-HEXANE PER MILLION STANDARD CUBIC FEET OF NITROGEN
RESERVOIR PRESSURE (PSIA)

FIG. 8 — VAPORIZATION OF N-HEXANE WITH NITROGEN AT 150°F BY PRESSURE DEPLETION. SPACE VELOCITY, 0.733 RESERVOIR VOLUMES PER MINUTE. SAND PACKED BOMB, 5 PER CENT SATURATION OF N-HEXANE.

The values of f_n calculated from Equation (2) were subtracted from the total pressure to give the partial pressure of the nitrogen. The compressibility factor of the hydrocarbons was taken as one, and the fugacity was substituted for pressure in order to calculate the number of moles of hydrocarbon in 1 cu ft of gas mixture, using the following equation:

$$PV = Z\,n\,RT \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

The same expression was employed to calculate the number of moles of nitrogen in 1 cu ft of the mixture. Values of Z for nitrogen were taken from the work of Sage and Lacey.[4] Mole fractions were calculated, and densities determined by means of Equation (4).

$$Y_1\rho_1 + (1 - Y_1)\rho_2 = \rho_n \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

where Y_1 = mole fraction of component 1

ρ_1, ρ_2, ρ_n = density of component 1, component 2, and the mixture at 60°F

The quantities designated "reservoir volumes per minute" were calculated by dividing the volume of gas at standard conditions (60°F and 1 atmosphere) by the total volume of the reservoir.

Figs 10 and 11 present the results of the constant pressure sweep studies. In Fig. 11, "equilibrium recovery" indicated quantity of hydrocarbons recovered divided by the quantity predicted by Raoult's law.

DISCUSSION OF RESULTS

Unfortunately, no suitable equilibrium data are available with which to compare the results of this investigation. Boomer, Johnson and Piercey[1] determined the equilibrium composition of the nitrogen-n-heptane system at 100.9 atmospheres. It was found by interpolation of their data that at 100°F, the vapor-phase contained 1.34 per cent n-heptane, which corresponds to a specific gravity of 0.990. Fig. 5 of this paper shows the gravity of the gas under the above conditions to be approximately 0.982. Kilgore[2] determined equilibrium constants for the nitrogen-n-heptane system, but at temperatures too far removed from those used in the present studies for a valid comparison.

In spite of the fact that the curves drawn on Figs. 5, 6, 7 and 8 were calculated with such important effects as decrease in vapor pressure due to capillarity and shape of gas-liquid interface, preferential wettability of the sand, and change in vapor pressure of the liquid due to dissolved nitrogen being

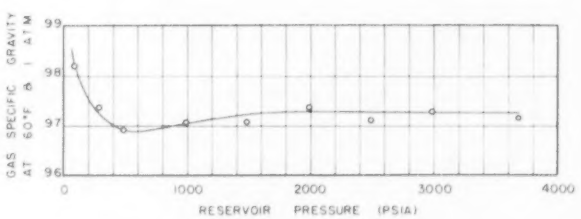

FIG. 9 — VAPORIZATION OF GWINVILLE, MISS., CONDENSATE WITH NITROGEN AT 100°F BY PRESSURE DEPLETION. SPACE VELOCITY, 0.622 RESERVOIR VOLUMES PER MINUTE, 10 PER CENT SATURATION OF CONDENSATE IN SAND PACKED BOMB.

neglected, there is a marked similarity between theoretical and experimental points. Only in Fig. 6 do the experimental data from a sand packed bomb show a lower gravity than the theoretical curve, and this only at high pressure. The gravity from data on the unpacked bomb is consistently lower than the gravity from the packed bombs. This phenomenon was also observed by Weinaug and Cordell.[5]

Fig. 7 indicates that the presence of water or brine has very little effect on the quantity of hydrocarbon vaporized. It will be noticed, however, that the data points of Fig. 7 do not drop below the theoretical curve as did those of Fig. 6. It has been suggested[4] that the preferential wettability may change with pressure, and this could account for the discrepancy.

Figs. 5, 6 and 7 lead to the conclusion that the higher hydrocarbons can be revaporized from a porous body, and that, within the range studied, withdrawal rate and the presence of brine and water within the reservoir have very little effect upon the vaporization of the hydrocarbons.

The constant pressure vaporization studies showed that the approach to equilibrium is a function of the space velocity. However, since the departure from 100 per cent of equilibrium recovery takes place up to a space velocity of approximately

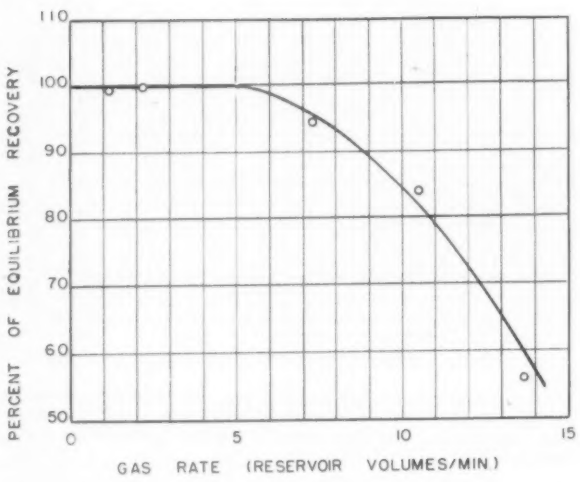

FIG. 11 — EFFECT OF SPACE VELOCITY ON APPROACH TO EQUILIBRIUM IN SWEEP VAPORIZATION OF N-HEXANE WITH NITROGEN, ATMOSPHERIC PRESSURE IN SAND PACKED TUBE.

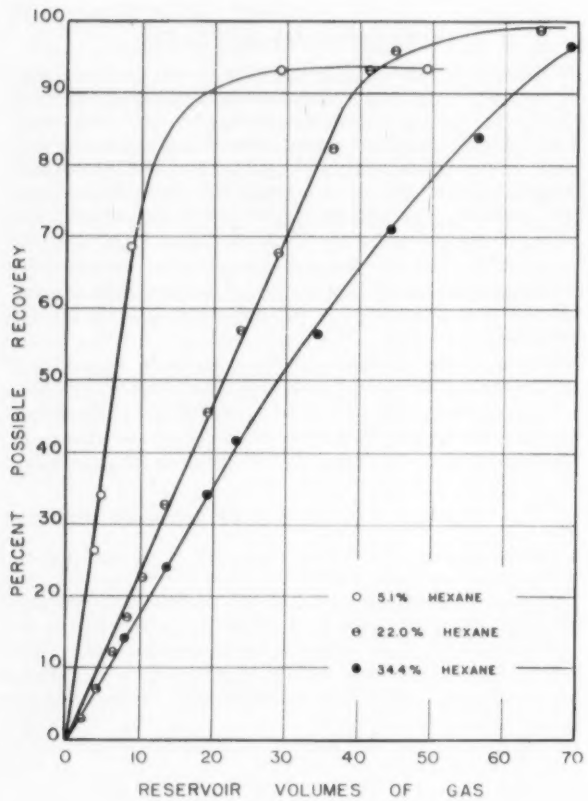

FIG. 10 — EFFECT OF LIQUID SATURATION ON RECOVERY OF N-HEXANE WITH NITROGEN BY SWEEP METHOD, ATMOSPHERIC PRESSURE IN SAND PACKED TUBE.

5 reservoir volumes per minute, one would expect equilibrium recovery from producing reservoirs.

It must be emphasized that the sweep runs were not made on a constant permeability sand. Since the sand and hydrocarbon were mixed before the tube was packed, tapping the container did not produce a uniformly packed body, and as evaporation took place, the sand settled, thus decreasing the porosity and the permeability. Also, the sweep runs were not made at constant temperature. The temperature of the sand bed dropped 7 to 30°F, because of vaporization of the liquid and rose again toward the end of the run. For this reason, the equilibrium recovery had to be calculated for an average temperature. Nevertheless, it is thought that the data presented here will be of aid to engineers and others interested in the production of condensate fields.

ACKNOWLEDGMENT

The authors wish to express their appreciation to the Maloney-Crawford Tank and Manufacturing Co. of Tulsa, Okla., for the support of a fellowship which made this investigation possible.

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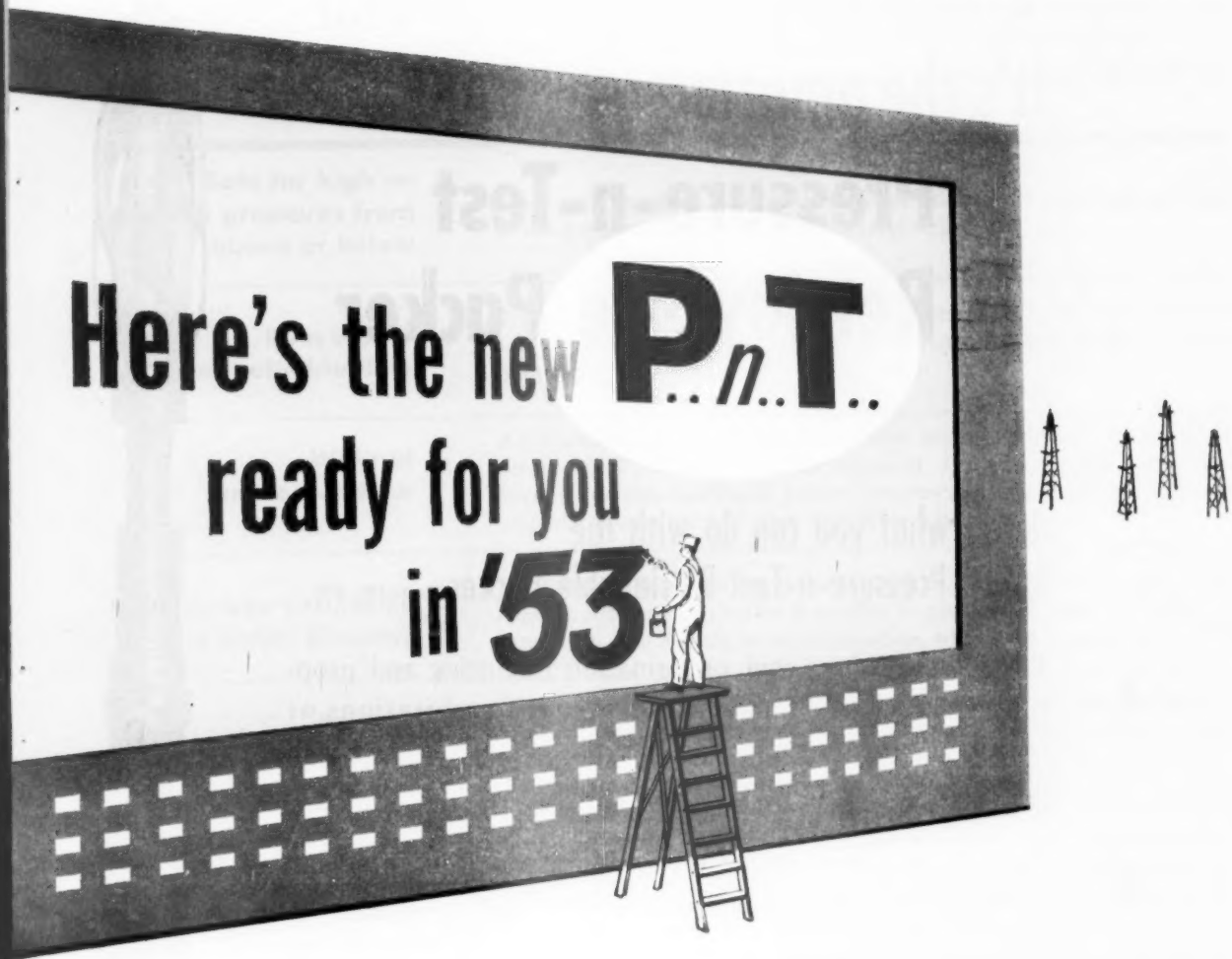
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Here's what you can do with the BAKER Pressure-n-Test Retrievable Packer (Product No. 413)

1. Place fluid, such as acid, or formation fracturing and propping agents, behind the casing (through perforations or other openings) at any pressure that is safe for the well equipment.

2. Test or swab prospective producing formations following acidizing or formation fracturing operations.

3. Test casing or surface connections – setting, releasing and re-setting the Pressure-n-Test Packer as *many times* as required, *without removal from the hole.*

4. Locate holes in the casing – above or below the packer – with no restriction as to the number of settings *on the same trip.*

5. Pressure-test the effectiveness of a previously performed cement job at any pressures safe for the casing and well equipment.

Another

Features and Advantages

The BAKER Pressure-n-Test Retrievable Packer has two sets of slips to prevent either upward or downward movement, and can be used for any type of pressure work, regardless of the direction of the pressure differential. When set, it will hold any pressure differential from BELOW the packer that is safe for the well equipment. It will hold any pressure differential from ABOVE the packer up to 5,000 psi.

Safe for high or low pressures from above or below

This packer functions with equal safety and efficiency in either high-pressure or low-pressure wells, or in low fluid level wells.

Runs in fast Saves valuable time

Depending upon the setting depth, the Pressure-n-Test Packer will save from 1 to 4 hours as against the time required to run a similar tool equipped with swab cups.

Will not cause overflow

A Circulation By-Pass provides circulation area in addition to the clearance between the Packer and the ID of the casing. The total circulation area thus provided permits running-in without overflow; and effectively reduces any tendency to swab the well when the packer is being retrieved.

Permits free circulation in either direction

The Packing Element is not in contact with the casing at any point when in released position. This makes it possible to circulate completely around the Pressure-n-Test Packer, in either direction, when such action is desirable.

Permits circulation even if packing unit sticks

Should scale, sand, propping agents, or debris settle above the packing element and prevent its release, setting down the weight of the running-in string will open the valve of the Circulation By-Pass and permit washing around the lower end of the Packer and above the Packing Element. This washing action circulates the settlings out of the hole, and frees Packer for normal operation.

Releases readily in emergency

In event the Packer should fail to release in the normal manner, a few turns *to the right* will release the Upper Slips which usually permits removal of the *entire* Packer from the hole. However, in case the Packer does not release, a few more turns to the right will permit removal of the Upper Slips and the entire upper portion of the tool.

May be set—and released—and re-set at any place in the casing and as many times as desired

Without removing the running-in string from the well, the Baker Pressure-n-Test Retrievable Packer can be safely and effectively set and released *wherever* desired, and as *many times as desired.*

May be rotated out of the hole

When it is time to retrieve the Baker Pressure-n-Test Packer from the hole, approximately 30 turns *to the right* will lock the slips in retracted position, with the By-Pass Valve open, and the Packer can safely be rotated out of the hole without danger of setting or hanging up.

of the BAKER family of practical and dependable oil tools

Quick facts...*for busy operators*

Numerous design features that have been field-tested and proved successful in other Baker Products are incorporated in the Baker Pressure-n-Test Retrievable Packer, and are largely responsible for its successful operation.

The assembly consists of a Ratchet Mechanism controlled by Drag Springs; a set of Upper Slips to prevent *upward* movement; a set of Lower Slips to prevent *downward* movement; and an expandable, resilient Packing Element positioned between the two sets of slips.

Straight-through circulation permits all fluid to come out the Guide at the lower end of the assembly, below all working parts. A tail pipe is generally employed in order to spot fluid at any desired point below the Packer.

A Circulation By-Pass between the Body of the Packer and the Packing Element provides circulation area in addition to normal clearance between the Packer and the ID of the casing. Tendency to overflow while running-in, or to swab when coming out of the hole is thus minimized. This By-Pass is closed when the Packer is set.

Safety Releasing Features

A left-hand safety thread is provided between the Setting Mandrel and the Body of the Packer to jack the slips into retracted position should the Packer become stuck. Means also are provided to prevent dragging or setting the slips when retrieving, so that the Packer can be rotated safely out of the hole.

A Circulation Joint is run above the Baker Pressure-n-Test Retrievable Packer to assist in its release by equalizing pressure above and below the assembly.

Easy to operate—Safe to use—Easy to retrieve

Experienced operators approve...

1. ease of setting and releasing the Baker Pressure-n-Test Packer;
2. simplicity of repeated settings at any depth, without removal from the hole;
3. freedom from overflowing when running-in, or from swabbing when coming out of the well;
4. saving of running-in time as compared to similar devices using swab cups;
5. positive pack-off regardless of differential pressures from above or below;
6. safe, fast removal by rotating out of the hole.
7. the many safety features incorporated in the Pressure-n-Test Packer.

You, too, will appreciate the Baker Pressure-n-Test Retrievable Packer, and profit by using it. That's why we suggest you...

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In an era of rising prices,
Look what has happened to

The COST of Crude Oil

By Richard J. Gonzales

Humble Oil and Refining Co.

Crude oil is our most important source of energy in the United States. All forms of transportation are particularly dependent upon the products derived from it. In addition, crude oil provides heat and power for millions of homes and for countless machines in factories and on the farm. Essential in peace, oil is indispensable for national security, as the mobility of our military weapons is completely dependent upon petroleum power.

Our consumption of petroleum in the United States is about 2 gal per person daily. A gallon of oil weighs about 7 lb and refined products from it cost about 17 cents delivered to the consumer in the various forms used.* Our consumption of natural gas by weight and heat value is about half as much as our consumption of petroleum products. Our daily use of oil and gas together thus amounts to about 21 lb per capita, far in excess of our use of food or other raw materials. In terms of cost, these fuels are among the cheapest materials we buy today.

Oil and gas are used in great quantities in the United States because they are relatively cheap in terms of the earning power of the people and in terms of other commodities. Crude oil has been made available in the United States over the past 50 years in rapidly increasing quantities at costs which show a downward trend relative to average hourly earnings and remarkably little change in terms of wholesale prices for commodities generally. Such a record is surprising. Logically, one would expect that the law of diminishing returns would have brought about a substantial increase in the real costs of crude oil measured in terms of human work and capital requirements or in terms of the general level of prices. The increasing difficulties and costs of finding and developing new reserves of crude oil have been widely discussed during the past decade. Much of this discussion, however, has related to changes brought about by general inflation. To arrive at an accurate picture of real costs for crude oil it is necessary to take into account changes in the general level of prices.

Wholesale Price Trends, 1913-1952

The wholesale prices of crude oil and bituminous coal, its principal competitive fuel, have followed the same general pattern as that of all commodities. A sharp rise in price from 1913 through 1920 was followed by a downward trend until the bottom of the depression in 1931-1933. After the initial partial recovery from the depression, wholesale prices remained relatively stable for a number of years before beginning the long upward climb that reflected the inflationary forces in operation during and after World War II. After five years of price controls during World War II, there was a sharp rise in prices through 1948.

It will be noted from Fig. 1 that since 1926 the index of crude oil prices has been below that of all commodities. Under price controls in World War II wholesale prices generally and the price of coal continued to increase while crude oil was held at a practically constant level. The extent of postwar price adjustments for crude oil relative to other commodities reflected adjustments that would normally have taken place gradually over a period of time but for artificial price control. After 1948 there was a slight decline in prices, followed by a rise to new records for all commodities and coal after the outbreak of war in Korea, whereas crude oil prices are still not back up to the 1948 level.

Crude Oil Prices in Terms of Wholesale Commodity Prices

The general relation between the price of crude oil and wholesale commodity prices shown in Fig. 1 can be used to express the price of crude oil in terms of dollars of constant purchasing power. Fig. 2 shows this relation with 1952 as a base, so that prices in prior years are comparable with those currently in effect, measured in dollars of constant purchasing power for wholesale commodities generally. Five-year averages

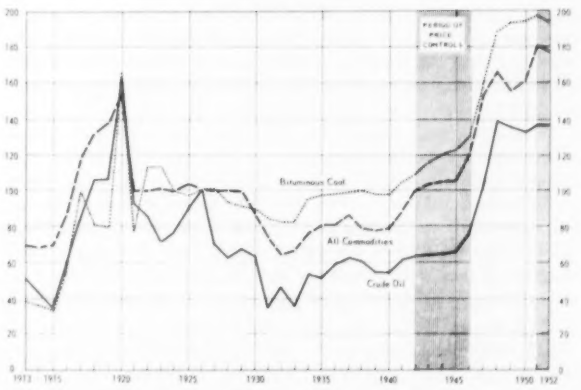


FIG. 1 — WHOLESALE PRICE TRENDS, 1913-1952. 1926 = 100.

*The products derived from a barrel of crude oil are about 42 per cent gasoline, 26 per cent middle distillate, 20 per cent residual fuel oil, and 12 per cent miscellaneous products. Retail prices vary greatly according to destination, but average about 20.5 cents a gallon, excluding tax, for gasoline; 15 cents for distillate; and about 5 cents a gallon for residual fuel oil. Allow for the sale of miscellaneous specialities at a higher price than for gasoline, the average realization at wholesale per gallon of products sold by the petroleum industry is about 17 cents.

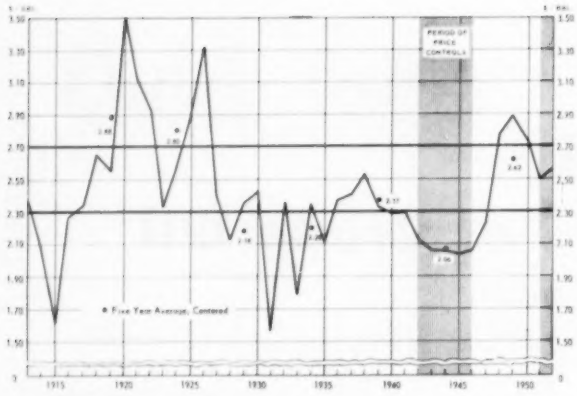


FIG. 2 — CRUDE OIL PRICES IN TERMS OF WHOLESALE COMMODITY PRICES. 1952 = 100.

of the price of crude oil in these terms have also been plotted. In addition, the figure shows a band of prices centered around the average price of nearly $2.50 over the entire period 1913-1952. A range within 8 per cent of $2.50 a bbl includes most of the average annual prices since 1913 except for the peaks and troughs related to the business cycle and for the period of artificial price controls.

Relatively little evidence can be found in the past 40 years of any upward trend in the real cost of crude oil measured in terms of wholesale prices of all commodities. In these constant terms the price of crude oil in 1952 is about the same as it was in 1938 and 1924. (It is also about the same as the price in 1903, although this is not shown on the chart.) In real purchasing power, the price currently is substantially less than in such prior years as 1948-1950, 1925-1926, and 1920-1922.

Analysis of the five-year averages of crude oil prices in terms of dollars with the same purchasing power as in 1952 indicates some downward trend from about 1920 to 1933. Since that time there has been a slight upward trend in the price of crude oil relative to wholesale commodity prices except for the subnormal average in 1942-1946 due to price controls.

The deviation in the price of crude oil under government controls in 1942-1946 from that of the preceding five years in a free market provides a minimum measure of the loss to crude oil producers in this period. The difference amounts to more than 30 cents a bbl in terms of present prices, or approximately $2.5 billion on the production of more than 8 billion bbl of oil in those years. Since the trend in crude oil prices relative to wholesale commodities generally was slightly upward prior to the war, the penalty of price controls on crude oil producers probably was more than this minimum estimate of $2.5 billion.

In the postwar years 1947-1951, the price of crude oil in relation to wholesale commodities was $2.62 a bbl, or less than 15 per cent above the average of $2.30 a bbl in the years 1930-1941. It is remarkable that the post-war price of crude oil in terms of purchasing power showed no more increase than it did over the level prevailing during the industry's most successful period of discovery and development.

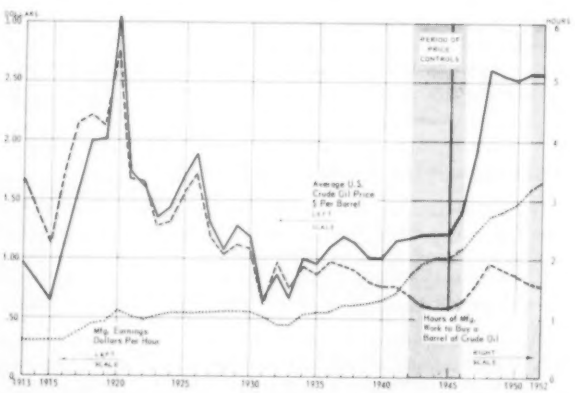
Price controls have again had an adverse effect on crude oil producers during the past two years as they did in the years 1942-1946. Under these controls, domestic crude oil producers have been permitted to realize a smaller real income per barrel than prevailed in the free market prior to beginning of war in Korea. Measured in dollars of 1952 purchasing power, real income per barrel in 1951-52 is 26 cents below the average in 1948-1950. On a crude oil production in excess of 4.5 billion bbl for these two years, the loss in real income has been nearly $1.2 billion.

Crude Oil Prices Relative to Average Hourly Earnings

Another measure of the cost of crude oil is provided by the number of hours of work required on the part of an average wage earner engaged in manufacturing to buy a barrel of oil. Fig. 3 shows this relationship for the period 1913-1952. The number of hours' pay for manufacturing employees required to equal the price of a barrel of crude oil decreased from three and a third in 1913 to about two in 1928, and about one and a half in 1941 and again in 1947 and 1952. Abnormal conditions and controls drove the relation between the price of crude oil and hourly pay in manufacturing down below one and a quarter for 1943-1945, but it was inevitable that this situation could not continue in a free market that reflected demand and costs. In 1952 it required the pay of less hours in manufacturing to buy a barrel of crude oil than in any prior year of unregulated prices, except for the depression years of 1931 and 1933, when the price of crude oil was unduly depressed due to the influence of production from the East Texas Field.

Gasoline Prices Relative to Average Hourly Earnings

While the relationships of Fig. 3 provide a measure of the real cost of crude oil, the interest of the public centers more in the price of refined products. Accordingly, Fig. 4 has been prepared to show the relation between the retail price of gasoline and rates of pay in manufacturing. This relationship has been expressed in terms of the hours of work required by wage earners in manufacturing to earn the price of 10 gal of gasoline, exclusive of sales taxes. The series on retail gasoline prices begins in 1919, at which time the pay for more than 5 hours of work in manufacturing was required to buy 10 gal of gasoline, exclusive of tax. The work required to buy 10 gal of gasoline decreased to about 2½ hours during the depression period 1931-1936. A further decline in the cost of gasoline relative to earnings in manufacturing continued through 1946 at which time it required the pay for about 1⅓ hours of work in manufacturing to buy 10 gal of gasoline, exclusive of sales taxes. There followed a leveling off in the relation between


PERIOD OF PRICE CONTROLS
Average U.S. Crude Oil Price $ Per Barrel
Mfg. Earnings Dollars Per Hour
Hours of Mfg. Work to Buy a Barrel of Crude Oil

F.G. 3 — CRUDE OIL PRICES RELATIVE TO AVERAGE HOURLY EARNINGS.

gasoline prices and average hourly earnings for several years but the downward trend was resumed again in 1951 and has continued this year. Today it requires the pay of less than one and a quarter hours of work in manufacturing to buy 10 gal of gasoline, exclusive of sales taxes. In terms of this important measure, gasoline now costs less than one-fourth as much as it did in 1919-1922 and continues to show a downward trend.

Trends shown in Figs. 2-4 represent remarkable achievements by the oil industry in the light of factors tending to increase the difficulties of finding and producing petroleum. These factors include (1) more intensive and expensive search for oil, (2) the discovery of fewer very large fields, (3) greater average depth for wells, (4) an increasing proportion of deep wells which are particularly expensive, and (5) the apparent tendency toward a lower reserve per acre in new discoveries.

Offsetting these forces which tend to increase real costs have been the best efforts of the industry along several lines. Engineering progress in the form of improved technology and greater knowledge about means of increasing recovery from oil fields have contributed not only to the development of reserves that otherwise would not have been available but also to the control of real costs. The extent of this progress cannot be reviewed here, but articles by others indicate that it is remarkable.

Wider spacing of wells as a result of conservation laws and good management has been another major force enabling the industry to offset the tendency toward higher costs. Much of the drilling today is on a pattern of one well to 20 or 40 acres, whereas in the '30's the pattern was frequently one well to 5 or 10 acres, and prior to that time drilling was generally on very close spacing. In a period of increasing costs per well drilled and decreasing reserves per acre, wider spacing has been of the greatest importance in the economics of the oil industry in the United States.

An indication of the great advance in developing reserves with fewer wells is provided by comparison of the early history of the industry with the more recent experience in the past quarter century as is shown by Fig. 5. In the years from 1859 through 1925, nearly 700,000 wells were completed by the oil industry in the United States. These wells developed proved reserves of approximately 13 billion bbl, or less than 20,000 bbl per well. In the period 1926-1951, the industry again drilled nearly 700,000 wells but in this period the new reserves developed were more than 57 billion bbl, or in excess of 80,000 bbl per well. In other words, more than four times as much oil

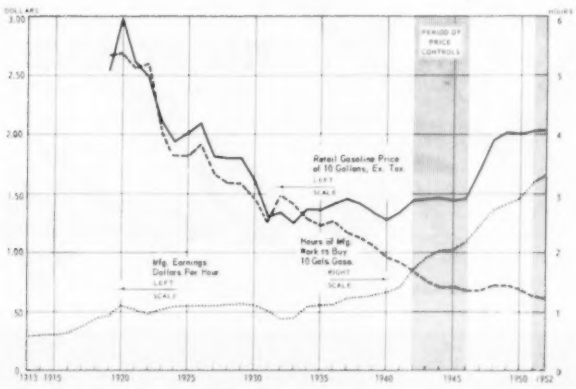

Retail Gasoline Price of 10 Gallons, Ex. Tax
Hours of Mfg. Work to Buy 10 Gals. Gaso.
Mfg. Earnings Dollars Per Hour
PERIOD OF PRICE CONTROLS

FIG. 4 — GASOLINE PRICES RELATIVE TO AVERAGE HOURLY EARNINGS.

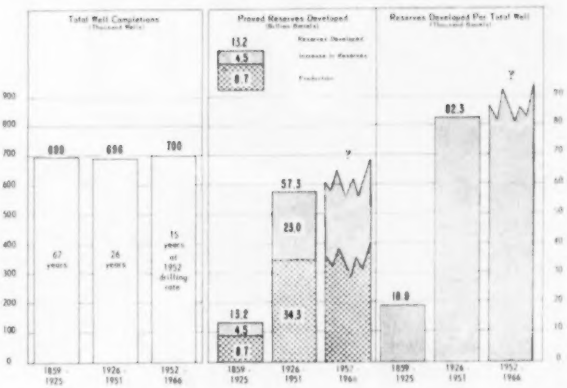


FIG. 5 — WELL COMPLETIONS AND CRUDE RESERVES DEVELOPED.

was developed per well in 1926-1951 as in 1859-1925. At the 1952 rate of drilling, another 700,000 wells may be drilled within the next 15 years. The amount of oil these wells will discover and develop and the real cost of this oil in terms of commodity prices generally will depend upon the success of the industry in continuing to offset tendencies toward increasing costs with progress in engineering and development.

There have been charges from uninformed sources that conservation has been used as a means of price fixing and that the oil industry is fabulously profitable. Analysis of the record shows that these charges are false. If conservation had been used as a means of price fixing one would expect to find the price of oil maintained at a high level relative to its competitive fuel, coal, and to commodities in general. As shown by the statistics and charts herein, there is no evidence of such tendency in crude oil prices. On the contrary, under keen competition within the industry and with competitive fuels, crude oil and refined products have been provided at remarkably low prices which have meant a generally decreasing trend in real costs to the consumer despite the forces operating to bring about higher real costs. The fact that the average well completed by the industry in its period of greatest success in discovery of oil has served to develop only about 80,000 bbl is sufficient answer to those who think that there are fabulous profits in the search for and development of new oil, particularly in view of the vast amounts of capital spent on exploration and drilling.

As in the past, the petroleum industry continues to be faced with forces which make it harder to find and develop new reserves. The industry is aware of these problems and continues alert to every means of offsetting these forces through improved technology and better management. The search for oil is carried into new promising areas and continued in old areas which seem most likely to provide discoveries at reasonable cost. Exploration techniques and methods of drilling and completing wells are constantly being improved. Studies of reservoir performance throw new light on means of controlling production in order to increase the amount of oil recovered from producing formations. Wider spacing of wells continues to offer possibilities for the control of costs. These and other means are constantly being studied by operators in the industry in their efforts to develop reserves at reasonable costs. Through these efforts the industry has served the American public in a remarkable manner and will no doubt continue to provide it with low-cost, convenient fuels for the foreseeable future. ★ ★ ★

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ELEMENTS OF PETROLEUM PRODUCTION — X

Condensate Production

Reported by J. A. Klotz
Pacific Technology Forum

Milan G. Arthur, assistant chief petroleum engineer for the Union Oil Co. of California, presented the tenth and last talk of the series on "Elements of Petroleum Production" that is being sponsored by the Pacific Technology Forum. In this series, the AIME presented to engineers of the Los Angeles Basin ten aspects of petroleum production. The first three talks of the series discussed elements of petroleum exploration: Petroleum geology, petroleum prospecting, and electric logging. The next three talks discussed fundamentals of reservoir engineering: core analysis, reservoir fluid properties, and analysis of flow in oil reservoirs. The last four talks discussed methods of analyzing and of predicting production from reservoirs that produce by four different methods. Each of the talks was given by a man who is widely known for work that he has done on the subject of his talk.

For the last talk, Arthur discussed production from condensate reservoirs. In particular, he discussed economic and engineering considerations that should be used in a decision to cycle a particular reservoir and in design of the cycling plant. He showed that although cycling may result in greater ultimate liquid production than simple pressure depletion production, pressure depletion production may sometimes yield the greatest financial gain. Arthur first discussed the properties of condensate reservoirs that distinguish them from dark oil reservoirs or from gas reservoirs; he then talked about methods and processes for producing condensate reservoirs, and finally presented an economic analysis that compared high pressure and low pressure cycling.

Condensate Reservoirs

The characteristic that distinguishes condensate reservoirs from dark oil or gas reservoirs is the composition of the condensate reservoir fluid. Condensate fluids are intermediate fluids. They contain a higher percentage of compounds between butane, C_4, and octane, C_8, than either dark oils or dry gases. In the virgin reservoir, condensate fluids usually exist as a single phase. Their composition, however, causes retrograde condensation to occur within the reservoir. As reservoir pressure decreases, heavier components condense. The volume of the condensed phase reaches a maximum; then this phase revaporizes until the reservoir pressure falls below the dew-point pressure, when the reservoir fluid again exists in a single phase. Usually, the maximum volume of condensed liquid is so small that liquid saturation within the formation pores does not become great enough to allow the condensed liquid to flow. The liquid revaporizes at low pressure, but recovery of this revaporized liquid is usually uneconomic. Because of this retrograde behavior, engineering considerations behind planning condensate production depend more upon the thermodynamic properties of the reservoir fluid than upon the hydrodynamic properties of the reservoir fluid and the reservoir rock.

Production by Pressure Depletion

Because of the high compressibility of condensate fluid, condensate reservoirs behave in the same manner that dry gas reservoirs behave. The decline of reservoir pressure can be calculated readily by a material balance. The gas-oil ratio of condensate reservoirs is high, usually between 10,000 and 50,000 cfb. The liquid condensate that forms in gas traps and lead lines is colorless or straw colored; its gravity is high, usually 48° API or greater. As gas is produced and reservoir pressure declines, the concentration of light compounds, methane and ethane, in the reservoir decreases continually; and the concentration of heavy compounds, hexanes, heptanes, and heavier, increases. About 40 per cent of the compounds heavier than butane may be lost by retrograde condensation within the reservoir.

Production by Cycling

Liquid hydrocarbons have been economically more valuable than gaseous hydrocarbons. The expenditure of considerable money may be justified, therefore, if this expenditure results in production of more liquid than would be realized by simple pressure depletion production of a condensate reservoir. This increased liquid production can best be accomplished by the process known as cycling. In this process, dry gas is separated from the condensable liquids, and reinjected into the reservoir. Injection, or cycling of dry gas accomplishes several purposes. The first purpose is to maintain high reservoir pressure so that retrograde condensation is minimized within the reservoir. Secondary purposes of dry gas cycling are to maintain high well production rates and to store dry gas until market is available.

Although the thermodynamic properties of reservoir fluids are more important in condensate reservoirs than in other reservoirs, the flow of injected dry gas is controlled by the hydrodynamic properties of the reservoir. This flow, therefore, is subject to the same limitations that confront the operator of a water flood project or a gas injection project in a normal dark oil reservoir. Injection wells and production wells must be located properly, and injection and production rates must be controlled to eliminate unswept areas within the reservoir. The optimum drilling pattern and the optimum production and injection rates can usually be determined by potential theory analysis or by flow models.

Close spacing of wells permits flexible control over the injection and production rates, provides more reservoir data from which accurate engineering calculations can be made, and enables the operator to detect channeling of dry gas or bypassing of unswept areas. Wide spacing of wells is more common than close spacing, however, because even a rich condensate pool, GOR 10,000 cfb, will produce only about 200 bbl of condensate for each acre foot of reservoir volume. Wide spacing of wells also tends to increase overall sweep efficiency of the injected dry gas; however, vertical permeability variation may

be a more serious limit to efficient cycling than low areal sweep efficiency.

In principle, condensate reservoirs can be cycled at any pressure. Original reservoir pressure is usually equal to or above the retrograde dewpoint, however, so that no advantage is gained by cycling at pressures above the original pressure. The recovery of liquid condensate, butanes and heavier, will depend on the cycling pressure. In 1948, Standing, Lindblad and Parsons[1] showed that, for many condensate reservoirs, cycling at low pressures resulted in higher ultimate recovery of the butanes and heavier than cycling at high pressures. Liquid condensate (usually considered to be butanes and heavier) will be recovered more rapidly, however, if the reservoir is cycled at high pressure than if it is cycled at low pressure. For example, for the Standing, Lindblad and Parsons data, the butanes plus content of the produced gas will be about 3 gal per Mcf after 100 pore volumes of dry gas have been injected at the original reservoir pressure of 2,960 psi, but the content will be only 1.8 gal per Mcf if the reservoir is cycled at 1,300 psi. Also, if a condensate reservoir is cycled at a low pressure, the production rate from each well will be low and the minimum economic production rate may be reached before more than a small portion of the condensate is produced.

Economics of Cycling

In order to compare the economic value of cycling at different pressures, Arthur presented an analysis of a hypothetical condensate reservoir. On the basis of assumed fluid properties, reservoir characteristics, cycling plant capital and operating costs, and assumed prices for saleable products, he calculated the total condensate recovery, rates of recovery, and the resulting net operating profit. The calculation was made for three different cycling pressures: (1) the original reservoir pressure, (2) a pressure equal to about 40 per cent of the original pressure, and (3) a pressure equal to about 12 per cent of the original pressure. Assumptions for this hypothetical reservoir are summarized in Table 1, which is a condensation of a table presented by Arthur in 1948.[2]

The analysis that Arthur presented showed that although high pressure or intermediate pressure cycling resulted in the production of about 30 per cent more condensate than low pressure cycling and yielded about 18 per cent greater operating profit, the present worth of the operating profit is about the same for cycling at high, intermediate, or low pressure. The relatively low operating profit obtained from low pressure cycling has a high present worth because it can be collected at a much higher rate than the profit for the high pressure or intermediate cycling processes. The producing life of the low pressure cycling process is about 60 per cent of the life of the high pressure process.

Cycling plant operation costs are less for low pressure cycling than for high pressure cycling so that although total field production is less, low pressure cycling might be expected to be the most profitable method.

Arthur pointed out, however, several sources of increased cost in low pressure cycling. Among these sources was the low production rate of wells. For example, the second 10 years of the high pressure cycling process produced 7 million bbl of condensate while the second 10 years of the low pressure process produced only 4 million bbl of condensate, and the average production rate of each well for low pressure cycling was only 40 per cent of the production rate of each well for high pressure cycling. As a result of low well productivity, 60 wells were drilled for the low pressure process in contrast to 30 wells drilled for the high pressure process. Because of this difference in the number of wells drilled, the field investment and field operation cost for the high pressure process was only about 62 per cent of the investment and operation cost for the low pressure process.

The results of this particular economic analysis are summarized in Table 2 and shown graphically in Fig. 1.

Fig. 1 shows cumulative profits converted to their present worth for each of the three cycling processes. For high pressure cycling, profits accumulated rapidly for the first 10 years. Then, as dry gas begins to break through to producing wells, condensate production rate drops and profit rate drops accordingly. After 14 years, cycling is stopped and the profit rate increases because operation costs drop markedly.

For intermediate and low pressure cycling, the profit rate for the first seven years is even greater than the profit rate for

Table 1

1. Hydrocarbon composition: as given by Standing, Lindblad and Parsons.	
2. Initial reservoir pressure (dewpoint), psi	2,960
3. Original Reserve	
Wet gas, std cu ft	300,000,000
Butanes and heavier, bbl	38,600,000
4. Effective reservoir permeability, md	8
5. Permeability variation	0.55
6. Dry gas sweep efficiency, per cent	75
7. Sand volume, acre ft	270,000
8. Gas plant capacity, std Mcf/D	70,000
9. Well development cost, dollars per well	70,000
10. Well and field operating cost, including repair, dollars per day well	4.50
11. Ad valorem taxes, per cent of net profits	8.0
12. Interest rate to convert future profits to present worth, per cent compounded annually	4.0
13. Price of products	
Condensate, dollars per bbl	2.24
Gas, cents per Mcf	12

Table 2 — Summary of Cycling Economics

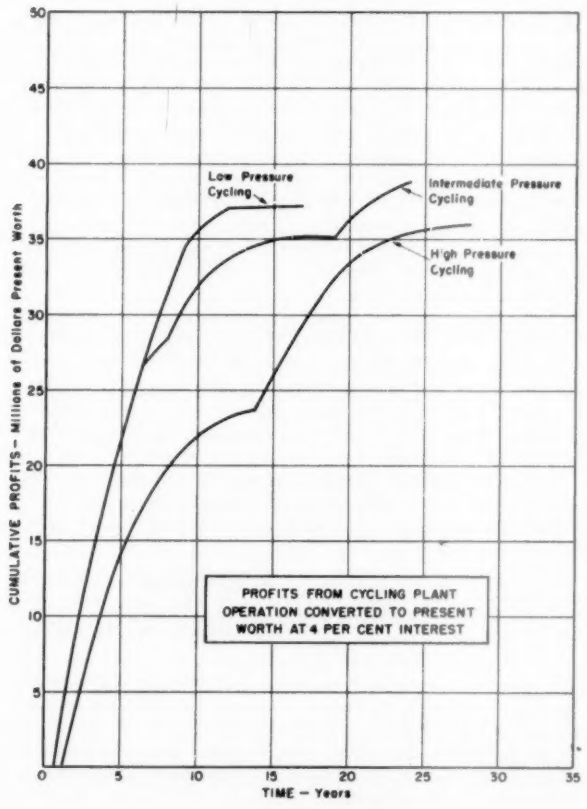
	Cycling at: Reservoir Pressure 2,960 psi	Intermediate Pressure 1,310 psi	Low Pressure 400 psi
Condensate recovery			
million of barrels	31.6	30.5	23.0
per cent of original	82.0	79.1	59.6
Salable gas production, million of cu ft	231.9	245.5	251.3
Gross income, millions of dollars	102	101	84
Total investment and operating costs (exclusive of taxes), millions of dollars	43.1	45.1	35.2
Operating profit, before taxes			
million of dollars	58.6	55.7	48.8
after ad valorem taxes			
million of dollars	53.9	51.2	44.9
Present worth discounted at 4 per cent interest, millions of dollars	36.0	38.9	37.3
Producing life, years	28	24	17

the high pressure process. This is because the reservoir is being produced without cycling and there are no plant operation costs. At the end of seven years, reservoir pressure had declined to 1,310 psi, and intermediate pressure cycling started. Profit rate declined rapidly as plant operation costs increased.

The profit rate for the low pressure process did not start to decline until after the ninth year, when well productivity began to decline. Although low pressure cycling between the twelfth and seventeenth year resulted in production of about 3 million bbl of condensate, the profit rate during this time was very low. No final profit surge was realized because the reservoir was already at such a low pressure that final blowdown production could not be obtained.

In a recent paper Riley and Cole of the Stanolind Oil and Gas Co.[3] presented an analysis which is similar to the one that Arthur[2] presented. The Stanolind authors analyzed a rich reservoir and a lean reservoir. They showed that cycling of a rich reservoir resulted in a high profit rate, if profits are discounted to present worth, but that after several years of production, net cash position reached a maximum then declined slightly. Their lean reservoir analysis showed that the cash position was about the same whether the reservoir was cycled or pressure depleted. The analysis also showed that about the same amount of energy, expressed as Btu's, was recovered from the lean reservoir whether or not it was cycled, but cycling the rich reservoir increased the net energy production about 3 per cent.

Arthur concluded his talk with the statement that economic analysis of cycling operations show that increased income obtained from cycling may be counterbalanced by the increased cost of the cycling process. Although cycling usually leads to higher recovery of liquid hydrocarbons than pressure depletion, pressure depletion may be economically more attractive for some reservoirs.



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1. Standing, M. B., Lindblad, E. N., Parsons, R. L.: *Trans.* AIME, (1948) 174.
2. Arthur, M. G.: *API Drill. Prod. Prac.*, (1948) 144.
3. Riley, H. G., and Cole, C. M.: Fourth Texas Oil Recovery Conference, Austin, Tex., (May, 1952).

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Study Group Hears Talk On Healdton Field, Oklahoma

Reported by W. B. Davis
Mid-Continent Section

C. H. Riggs, head of engineering field studies for secondary recovery at the U. S. Bureau of Mines Petroleum Experiment Station in Bartlesville, Okla., spoke before a recent meeting of the Mid-Continent Section Study Group. Riggs' talk, "Secondary Recovery and Future Possibilities in the Healdton Field, Oklahoma," was a summary of the USBM R. I. No. 4917, published in February, 1953. Co-authors with Riggs of the report were John E. Wey, Edward Sanabria, Jr., Paul Meadows, William C. Smith and James A. West.

The Healdton Field in Carter County, Okla., about 20 miles west of Ardmore, was discovered in 1913. Oil production is from lenticular Healdton sands of late Pennsylvanian age, which range in depth from 700 ft to 1,400 ft. Apparently these sands were deposited unconformably around and over a topographic high of the eroded Ordovician surface. During Mesozoic time the area was folded and faulted to form a modified anticlinal structure. The field contains about 7,100 productive acres. About 2,600 wells have been drilled, of which about 1,900 were still producing at the end of 1951. Oil gravity ranges from 26° to 35° API. The Healdton sands are considered to consist of four zones. Production from the four sand zones has been commingled on most of the leases. The average effective sand thickness for the four zones taken together amounts to 72 ft. The average porosity is 21.6 per cent and the average permeability 330 md. It is estimated that the reservoir originally contained about 675 million bbl of stock tank oil. Cumulative production to the first of 1951 amounted to about 211 million bbl or about 30,000 bbl per acre.

The fourth sand (lowest stratigraphically) is believed to have a natural water drive and a large per cent of the oil in place will be recovered; however, the first three sands are believed to have produced primarily by a solution gas drive and should contain a large volume of oil unrecoverable by primary production methods.

Air and gas injection have been tried on a limited scale with comparatively little success; however, the limited success of these projects does not preclude the possibility of obtaining large volumes of additional oil by the process of water flooding, which has not yet been tried in the field. He estimated that there are over 200 million bbl of oil theoretically recoverable by water flooding and that a substantial portion of this volume probably could be recovered by well-engineered and carefully controlled water floods.

★ ★ ★

Corrosion and Its Control

Reported by Fred R. Mulker
Pacific Junior Group

The important role that corrosion plays in the cost and production behavior of oil wells is attracting more and more attention throughout the United States. In California, as elsewhere, many studies of the mechanics and chemistry of corrosion are being made and increasing numbers of experiments for corrosion control are being conducted.

The Junior Group of the Pacific Petroleum Chapter recently sponsored a round-table discussion on oil well corrosion. Several authorities were on hand to present introductory remarks and to spark the discussion with the technical and economic aspects of corrosion control. Here are the principles discussed, some of the questions, and a few of the answers.

CORROSION PROCESS

Oil well corrosion is defined as the acidic attack on the ferrous metals within the well. Hydrogen ions occur due to the presence of hydrogen sulfide, carbon dioxide, or fatty acids. They rob electrons from the iron in the tubing, rods, pump, and liner to form hydrogen gas. This leaves the ferrous ions in solution, resulting in the corrosion of the parent metal, and in the extreme condition to its complete dissolution. This is more accurately called electrochemical corrosion.

Hydrogen sulfide and carbon dioxide are the usual sources that produce acidic attack. In order to have conditions encouraging electrochemical corrosion a water cut in the produced fluid is required, but it need not necessarily be a high cut. Small amounts of water can carry potent quantities of CO_2 and H_2S, the reactions being:

$$CO_2 + H_2O \rightarrow H^+ + HCO_3^-$$
$$\text{or:} \quad H_2S \rightarrow H^+ + HS^-$$

However, due to electropotential conditions in some wells even relatively small quantities of CO_2 and H_2S may cause these wells to be highly corrosive.

INDICATIONS OF CORROSIVE ACTION

The frequent pulling of a well to replace worn pump, rods, boxes, and tubing usually is the reason for suspecting corrosive conditions in the well. Actually, frequent pulling jobs are often mistakenly attributed to wear, yet the major trouble may be caused by electrochemical corrosion.

"Wear" and "electrochemical corrosion" go hand-in-hand; each aggravates the other, the result being to accelerate manyfold the time of ultimate failure. If a small pit or wormtrack results from corrosion, any movement along this point by another piece of metal causes digging in and shearing of the highs, leaving them freshly exposed for new and vigorous corrosive attack.

Operators can obtain other indications of a corrosive condition in an oil well. Iron counts are taken of the produced water phase, and this measure is readily convertible to pounds of iron per day, month, or year. Corrosion control often starts when the iron count reaches 25 parts per million. The fact that these parts of iron are from the steel in the hole rather than from the formation has been stated by D. M. McCloud, of Magna Products, Inc., whose records show only a few, if any, California connate waters which in themselves have an appreciable iron content.

Also, coupon tests can be run. Appropriate metallic coupons can be soaked and washed in production waters and the corrosive effects observed in the laboratory.

J. Shannon Baker, of Lane-Wells Co., described the corrosion of logging cables and sand lines. Here the action does not occur in an anaerobic environment (as it does in oil wells) but instead, frequent exposures to air allow direct formation of iron oxide and other metallic oxides every time the line is spooled coming out of the well. Galvanizing the wires in a wire line has not afforded much protection to date. It was suggested that some control could be obtained by braiding a magnesium wire into the line to prolong its useful life.

WAYS OF COMBATTING CORROSION

Various companies handle the corrosion problem in different ways.

Alloys

Stainless steel and monel have been used to minimize the action, although stainless steel requires the presence of oxygen to be corrosion-resistant. Oftentimes superior alloys induce a galvanic destruction of the less noble metals in the well, aiding the already present corrosive action.

Neutralizers

The question arose as to whether it would be practical to introduce enough caustic into the annulus of the wells to neutralize the acids therein. However, quantities required would make the cost prohibitive.

Inhibitors

Corrosion inhibitors are used by most companies. These inhibitors are so-called "film-formers," as they introduce a film of material directly onto the susceptible metals. The inhibitors are most commonly injected into the annulus of the well, either by dumping or by pumping against the casing pressure of the well. They should be weighed up to a specific gravity greater than that of the well fluids so that they can circulate down the annulus and the residuals can then be picked up by the pump and returned to the surface through the tubing.

There are the physically-adsorbed films, which coat both the anodic and cathodic areas on the metal surface. It was said that this type affords both lubrication and insulation but lacks sufficient hardness and stability in areas subject to wear.

There are the chemi-adsorbed films, which also coat both the anodes and cathodes and have greater persistency and resistance to wear.

Then there are the reactive film formers, of molecular dimensions, which can be either of two types. The anodic type reacts and coats the anodic surfaces of the metal. The various chromates are of this type. Similarly, the cathodic types cover the metal surfaces in the well which happen to be serving as cathodes. The arsenicals, for example, form a tightly persistent film on the cathodes.

A. L. Mortimer, of Magna Products, Inc., pointed out that arsenicals are not compatible with the HS^- ion, so when H_2S is present, operators have successfully resorted to the chemi-adsorbed film type of inhibitors.

INDUSTRY-WIDE IMPORTANCE

The question arose as to how much electrochemical corrosion was currently costing the petroleum industry. No known estimates were available, but it was agreed that they would be astronomical. The value of corrosion inhibitors has been proven by many California oil producers, some of whom have released data showing up to 85 per cent reductions in production costs. These savings were realized due to lower maintenance costs, sustained production, and residual protection to surface equipment from leadlines to tanks. ★ ★ ★

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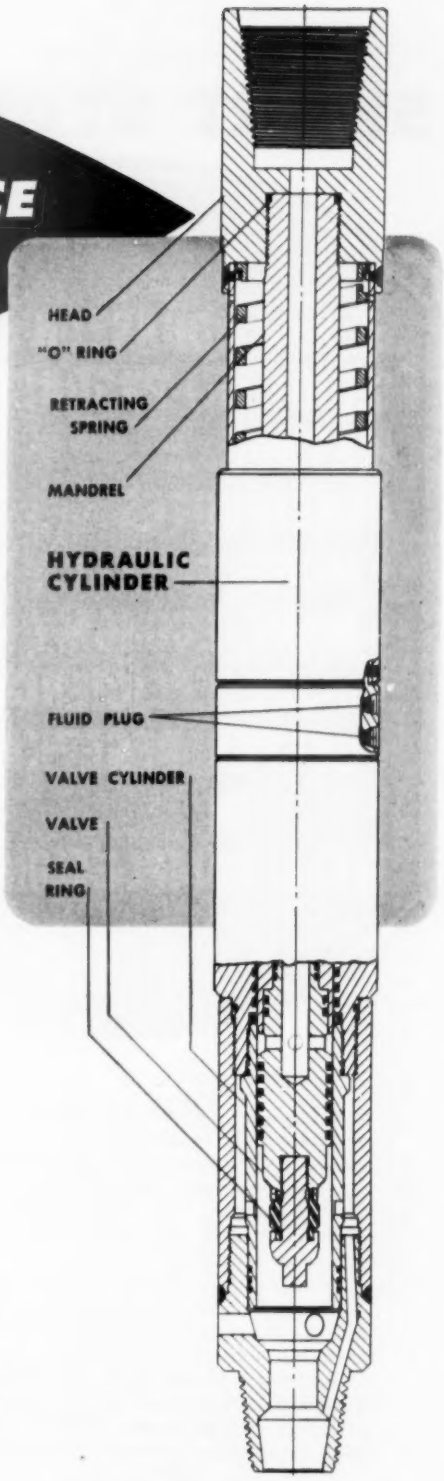

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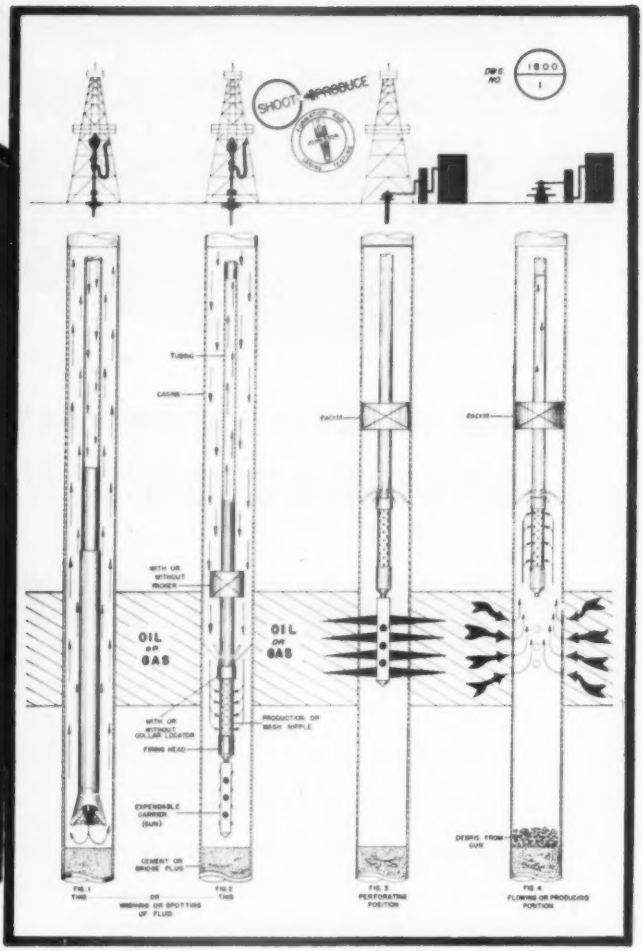

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Drawing No. 1800-1 shows the procedure used in the Shoot and Produce method. Fig. 1 shows casing has been cemented; the "Running-In-String" used for drilling and cleaning out to bottom can be used for displacing drilling mud with other fluids as oil and water, or spotting these fluids before pulling it to the surface. Fig. 2 shows a second method, with the Expendable Gun, Firing Head, Perforated Nipple, with or without Collar Locator, and with or without Production Packer in position for locating collars and displacing drilling mud with desirable fluids, or spotting other fluids. Fig. 3 shows perforating equipment in position, with or without packer, and Christmas Tree and surface equipment fully installed. The well is perforated by dropping the "Go-Devil" which shears Disc in Firing Head and exposes hydrostatic fluid pressure to piston in Firing Head which detonates the Expendable Gun. Fig. 4 shows production string and surface connections after perforation, with the well free to produce and debris on bottom.

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FORMATION AND CASING TESTING — JOHNSTON

Petroleum Branch Affairs

. . . as interpreted by JESS E. ADKINS
Editor, Journal of Petroleum Technology

Imports Bogy

Much has been said and written during the past few months about the effects, good and bad, of importation of crude into the United States. Reviewing the record, it is apparent that sentiments both pro and con have been built up gradually. There seemed to be no sudden awakening on the part of domestic producers to the fact that imports of crude were, and are, increasing while in some areas of controlled production allowables were, and are, being cut. But suddenly, during the past month, important men have expressed themselves on the subject for public consumption.

An item in *Petroleum World and Oil* reports that a vice-president of Sun Oil Co. "lashed out against the pro-imports recommendations of a presidential commission studying U. S. foreign trade policy, saying that they were 'extreme' and 'dangerous' as applied to the petroleum industry." The platform for this executive was the API production division meeting held in Pittsburgh last month. The gist of his remarks is that imports are taking the place of domestic production and therefore are disturbing the domestic market for crude.

On the other hand, this desk is in receipt of an announcement by Gulf Oil Corp. that it is "taking steps to reduce its imports of crude oil and products during the second quarter (of 1953) by 5 per cent below the quantities previously scheduled." The "quantities previously scheduled" amounted to 124,000 B/D of crude.

The Gulf points out that the reason for this cut-back in imports is due to the mild winter and a resultant oversupply of fuel oils. But, more importantly, the company takes the view that increasing imports of crude is nothing to become alarmed about. It believes that as demand in the United States rises over the years ahead a gradual increase in imports will probably be required. The crux of the Gulf's view is: "The U. S. accounts for 60 per cent of the world's oil consumption, but has only about 30 per cent of the world's proven reserves and probably less than that of the undiscovered reserves. If, therefore, consumption of oil in this country is to grow with its needs, domestic production undoubtedly will have to be augmented with an increasing quantity of oil from foreign sources."

The Gulf statement then winds up with the assertion that the company expresses "the view that current proposals to restrict oil imports by federal legislation are both unnecessary and unwise and that self-interest of the importing companies can be counted on to provide sufficient restraint on a voluntary basis, without any additional legislation, to avoid detrimental effect upon domestic crude production."

Meanwhile, the chairman of the board of Standard Oil Co. of California told members of the San Joaquin Valley Oil Producers Association last month that they could easily live with rising imports from the Middle East inasmuch as California is in an isolated position. Increasing production in the state can easily be absorbed by the industrial growth now taking place on the coast, he said.

How does all this affect the petroleum engineer whose job it is to find better and more economical ways of recovering oil from the earth?

The engineer is not concerned primarily with markets and the ramifications of supply and demand or the burdens of oversupply and underdemand. That is, he is not concerned until the needs for his services are jeopardized. Which means he can watch this battle of words between the proponents and opponents of increased imports more or less impassively. The engineer should take interest. After all, the oil that comes from Saudi Arabia, albeit of a different grade, is as good a lubricant in the eyes of the consumer as the oil that comes from the bayous of Louisiana or the plains of West Texas.

On the other hand, from the engineer's viewpoint, it is merely another job of work to apply reservoir engineering techniques to producing strata whether they be beneath Iraq or Venezuela, Canada or Oklahoma.

Petroleum Statistics

Until the current Volume 6, *Statistics of Oil and Gas Development and Production*, was published early this year, the practice of the Petroleum Branch, AIME, was to furnish each member who expressed a desire to own one a gratis copy of the current volume of this important work. However, the dictates of economy precluded this practice and a price of $5 to AIME members and $10 to nonmembers was placed on the publication effective with Vol. 6.

With the effecting of this policy, slightly more than 1,000 Petroleum Branch members made a decision against requesting their usual copy of the publication. As a result the Branch office has on hand a considerable number of these volumes covering production data of 1951. The publication itself is better than ever, more far reaching, more inclusive and more complete.

Elsewhere in this issue, on Page 13, Section 1, appears an advertisement announcing the availability of this important reference work. Many long weeks were spent by some of the best minds in the industry in compiling this latest volume. A clear record of production and development, both cumulative and during the period 1951, is available in one source book.

Within this advertisement appears an order form pointing out clearly the ways and means of ordering this most recent production data. The Petroleum Branch office is ready to fill these orders upon receipt.

Add AIME Prestige

AIME members continue to come forward to serve their country. Exhibiting the engineer's capabilities for management are such notables as Ex-President Herbert Hoover and Ambassador George C. McGhee. There are many more but these come quickly to mind. Now AIME Member Charles E. Wilson takes over the important function of Secretary of Defense in President Eisenhower's cabinet.

It is true that Secretary Wilson is an electrical engineer . . . but he is an AIME member nonetheless. He was graduated from Carnegie Institute of Technology and was soon employed by Westinghouse Electric and Manufacturing Co., after which time he fell under the influence of B. G. Lamme, chief engineer for Westinghouse. Much of Wilson's later success and knowledge was credited to Lamme.

It was in 1919 that Wilson joined General Motors as chief engineer and sales manager of the automobile division of the Remy Electric Co., a subsidiary of the motor company. From that date he rose steadily, succeeding to the presidency in 1941.

There is no moral to this engineer's rise to fame . . . unless it might be that he had to renounce his achievements to serve his country without undue criticism. Who else among us stands ready to imitate Secretary Wilson? ★ ★ ★

KANSAS SECTION OFFICERS for the current year are, standing, L to R, H. L. Temple and G. L. Yates, Directors; G. J. Decker, retiring Vice-Chairman; H. C. Davis, Director; and L. G. Chombart, Vice-Chairman for the Wichita district. Seated are B. B. Lane, Vice-Chairman for eastern Kansas; L. W. Holsapple, retiring Chairman; J. R. Puckett, 1953 Chairman; and R. L. Schick, Vice-Chairman for western Kansas.

Oklahoma Students Display Directional Drilling Model

A working model showing the control of wild wells with directional drilling was one of the highlights of the annual engineering exposition at the Oklahoma Institute of Technology last month. Designed by Dick Rundle and Jim Bonsall, the model was a part of the display entered by the Petroleum Engineers.

Next year, the Petroleum Engineering Club, an AIME Student Affiliate, plans to construct a scale model jacknife drilling rig, to be used as a teaching aid in petroleum classes. Current officers of the club are Jim Bonsall, Toronto, Can., President; Barney Kirkpatrick, Tulsa, Vice-President; Bill Salwaechter, Meeker, Okla, Treasurer; Elmo Blount, Cushing, Okla., Recording Secretary; and Denzel Eaton, Davenport, Okla., Tool Pusher. A. T. Woods is faculty sponsor. ★ ★ ★

$6,225 Donated for Student Paper Awards

Enough money has been raised to assure continuance of the National Student Prize Paper Contest on its present basis for some 13 years in the future. At the February Board meeting, Donald H. McLaughlin, chairman of a special committee to raise funds, reported that $6,225 had been collected from 26 individuals and eight corporations. Five prizes of $100 each are given annually, selection being made largely from those who have won Local Section prize contests. The donors of the $6,225 were: F. M. Adams, A. H. Bunker, M. D. Cooper, Cleveland Dodge, E. DeGolyer, H. N. Eavenson, A. Fletcher, L. Gates, C. W. Hamilton, H. K. Hochschild, R. P. Koenig, J. A. Martino, Paul D. Merica, D. H. McLaughlin, A. J. McNab, Harvey S. Mudd, F. S. Mulock, M. Muskat, E. L. Oliver, R. G. Page, E. C. Smith, H. DeWitt Smith, H. Shark, Heath Steele, J. R. Suman, J. F. Thompson, American Smelting and Refining Co., Ingersoll-Rand Co., Inland Steel Co., International Minerals and Chemical Corp., Kennecott Copper Corp., New Jersey Zinc Co., U. S. Potash Co., and Wah Chang Corp. ★ ★ ★

Southwest Texas Section Hears Student Papers

"Drilling Mediums," a paper by M. R. Grimes, Jr., was selected the best of four student papers recently presented before the Southwest Texas Section, and will be entered in the National Student Paper contest. Other papers heard by the group were "Gas Dehydration" by Fred H. Williams, "Radio Activity Well Logging," by N. A. Schmidt, and "Basic Problems Associated with Offshore Operations" by Dan Swanger. The authors are all seniors in the petroleum-gas engineering department of Texas A&I College, Kingsville, Tex. ★ ★ ★

Phelps Dodge Gives $11,800 To Douglas Medal Fund

Through the good offices of Louis S. Cates, chairman of the Phelps Dodge Corp., the directors of that company have voted to give the AIME $11,800 to bring the principal of the James Douglas Medal Fund up to approximately $15,000. This amount is required to make possible an annual award of the gold medal. The James Douglas Medal was established in 1922, the first of the Institute's major medals, with the intention to bestow the award annually. Income in recent years has been insufficient, however; the last award was to Francis C. Frary in 1950.

The James Douglas Medal for distinguished achievement in nonferrous metallurgy was named in honor of Douglas, who twice served as President of the AIME, in 1899 and 1900; was Vice-President from 1906 to 1911; and elected an Honorary Member in 1906. Douglas was the first president of Phelps Dodge after its incorporation and long a dominant figure in the company. Though not educated as such he was a most ingenious, even an inspired, metallurgist. His benefactions were many, including $100,000 to the AIME to set up the James Douglas Library Fund. The present gift from the Phelps Dodge Corp. to the Institute is therefore most appropriate. ★ ★ ★

14 Petroleum Schools Receive Atlantic Grants

Fourteen universities and colleges in the South, Southwest and Middle West have accepted awards for fellowships or scholarships offered by The Atlantic Refining Co., covering the academic year beginning next September. The awards were made for the purpose of encouraging outstanding undergraduate and graduate students in the study of techniques connected with crude oil production.

Studies specified in the awards will be carried on in a department of geology, geophysics, or chemical, petroleum, mechanical or electrical engineering of the various institutions. The fellowships have been accepted by Washington University and Rice Institute. Scholarships have been awarded to the University of Texas, Southern Methodist University, Texas A&M College, Texas Technological College, University of Oklahoma, Tulsa University, Louisiana State University, New Mexico School of Mines, Ohio State University, Georgia Institute of Technology, Colorado School of Mines and St. Louis University. ★ ★ ★

Institute Sets Awards To Be given in 1954

Authorization was voted at the meeting of the Board of Directors, AIME, at their meeting on Feb. 15, to grant the following awards at the Annual Meeting, Feb. 15-18, 1954: William Lawrence Saunders Mining Medal; Anthony F. Lucas Petroleum Medal; Charles F. Rand Medal for Mining Administration (or other use of Fund income); Robert W. Hunt Medal for an iron or steel paper; Robert H. Richards Award in Mineral Beneficiation; J. E. Johnson, Jr., Award for achievement in pig iron metallurgy; Rossiter W. Raymond Memorial Award for best paper published by AIME member under 33; Mathewson Gold Medal for best paper in physical metallurgy.

Members wishing to nominate candidates for these awards should address the AIME Secretary, or the chairman of the respective Award Committee. ★

Chemical Fellowships Offered at Oklahoma U.

Seven fellowships will be available in the school of chemical engineering at the University of Oklahoma for the coming academic year, it has been announced by R. L. Huntington, chairman of the school. The fellowships have been established by the American Gas Association; Black, Sivalls and Bryson, Inc.; Gulf Oil Corp.; Magnolia Petroleum Co.; Maloney-Crawford Tank and Manufacturing Co.; The Texas Co.; and the Dow Chemical Co. Details and application blanks may be obtained by writing to Huntington. ★ ★ ★

AIME Officership Qualifications Clarified

An addition to the memorandum entitled "Advice and Instructions to the Nominating Committee" was authorized by the Executive Committee of the Institute at its meeting on March 18, as follows: "It is the declared policy that any member of the Institute who is otherwise qualified to hold high office shall be eligible without limitation because of identification with any particular business or professional activity." ★ ★ ★

Lou-Ark Committees Named

Committee appointments announced last month by A. H. Crawford, chairman of the Lou-Ark Section, are Wayne McCann, by-laws; Sam J. Poythress, program; Ralph W. Collins, finance; and C. R. Olson, membership. ★ ★ ★

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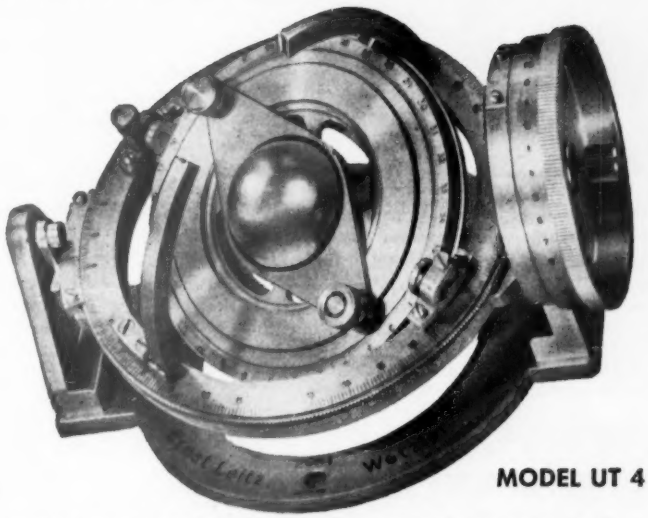

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Memorial – A. W. Ambrose

Arthur Warren Ambrose and Mrs. Ambrose were killed in an automobile collision near Tulsa, Okla., Dec. 28, 1952, while they were returning to Bartlesville, after a family visit. At the time of his death, Ambrose was chairman of the board of directors of Cities Service Oil Co. (Del.), a principal subsidiary of Cities Service Co.

Arthur Warren Ambrose was born at Lockeford, Calif., April 20, 1889 and received his primary education there. He completed his formal education at Stanford University with a bachelor's degree in geology and a master's degree in engineering received in 1920. He became a member of Sigma Xi largely because of his work in the fields of paleontology and geology. He was the author of the widely used treatise "Underground Conditions in Oil Fields."

His first full-time professional assignment as geologist came in 1914, when he joined Shell Co. at Coalinga, Calif. He remained in this position until 1917 when he accepted a position as geological engineer for Pomeroy and Hamilton, with headquarters in Houston, Tex. In 1918 Ambrose was named petroleum technologist for the U. S. Bureau of Mines, Washington, D. C. In 1920 he was named superintendent of the Petroleum Experiment Station at Bartlesville. In 1921 he was appointed chief petroleum technologist, U. S. Bureau of Mines, Washington, D. C., and in 1922 became assistant director of the bureau.

Ambrose left the Bureau of Mines in 1923 to become manager of the land and geological divisions of Cities Service Oil Co. Two years later his duties were expanded to included managership of the oil production division. In 1930, he was named vice-president and assistant general manager of the company. He became executive vice-president in 1941 and was elected to the presidency in 1946. He served as president until 1952 when he was elected chairman of the board.

He was a member of the American Institute of Mining and Metallurgical Engineers and at one time took a very active part in the Petroleum Division, of which he was chairman in 1928. He was a member and director of the American Petroleum Institute and of the Kansas-Oklahoma Division of the Mid-Continent Oil and Gas Association, of which he served as vice-president for Northern Oklahoma. He was a member of the American Association of Petroleum Geologists. He was an active Mason.

Ambrose was widely known in the petroleum industry and associates were prone to speak of him in superlatives. He was quiet, friendly and studious and conscientious. Geology remained his first love throughout most of his life. Besides his work, which absorbed his interest during most of his waking hours, he was a lover of the outdoors, particularly enjoyed horseback riding and hunting.

Ambrose was married to Alma Locke of Lockeford, Calif., on April 9, 1916. Surviving them are two daughters, Mrs. L. W. Hubbell of Tulsa, Okla., and Mrs. Robert C. Celum of Avenal, Calif.; and one son, Warren Locke Ambrose of Fort Worth, Tex. They also are survived by four grandchildren. ★ ★ ★

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Calgary and Edmonton, Alberta, Canada
Regina, Saskatchewan, Canada

Schedule of Local Section Meetings

DALLAS SECTION

Meeting City: Dallas, Tex.

CHAIRMAN	SECRETARY
E. R. Brownscombe	T. E. Morton
Atlantic Ref. Co.	Halliburton
Dallas, Tex.	Dallas, Tex.
PR-6484	RI-3841

Meets third Monday each month

DELTA SECTION

Meeting City: New Orleans, La.

CHAIRMAN	SECRETARY
R. S. Sullins	Byron L. Francis
Humble Oil & Ref. Co.	The Texas Co.
New Orleans, La.	New Orleans, La.
AU-8751	CA-8592

Meets second Tuesday each month

EAST TEXAS SECTION

Meeting Place: Gregg County Airport

CHAIRMAN	SECRETARY
H. L. Long	H. D. Miller
Independent Oil Op.	Amerada Pet. Corp.
Kilgore, Tex.	Longview, Tex.
Phone 4416	Phone 1878

Meets second Tuesday each month

FORT WORTH SECTION

Meeting City: Fort Worth, Tex.

CHAIRMAN	SECRETARY
H. J. Gruy	T. M. Curtis
Consultant	Stanolind Oil & Gas
Fort Worth, Tex.	Fort Worth, Tex.
FO-6157	FO-5661

Meets third Tuesday each month

GULF COAST SECTION

Meeting City: Houston, Tex.

CHAIRMAN	SECRETARY
Kenneth B. Ford	Pete Cawthon, Jr.
J. R. Butler & Co.	City National Bank
Houston, Tex.	Houston, Tex.
AT-9455	FA-2131

Meets third Tuesday each month

ILLINOIS BASIN CHAPTER

Meeting City: Salem, Ill.

CHAIRMAN	SECRETARY
Jerry Vaughan	Harry Bridges
Sun Oil Co.	Shell Oil Co.
Evansville, Ind.	Centralia, Ill.
Phone 3-4291	Phone 711

Meets first Thursday each month
(No meetings during July and August)

KANSAS SECTION

Meeting Cities: Wichita and Great Bend, Kans.

CHAIRMAN	SECRETARY
J. R. Puckett	John T. Gary
Magnolia Pet. Co.	Continental Oil Co.
Wichita, Kans.	Wichita, Kans.
4-1301	7-8347

Meets second Wednesday in Wichita, fourth Thursday in Great Bend
(No meetings during June, July and August)

LOU-ARK SECTION

Meeting City, Shreveport, La.

CHAIRMAN	SECRETARY
A. H. Crawford	L. R. Lacy
Crawford Drilling Co.	Phillips Pet. Co.
Shreveport, La.	Shreveport, La.
4-4441	2-3124

Meets tentatively first Monday each month

MID-CONTINENT SECTION

Meeting City: Tulsa, Okla.

CHAIRMAN	SECRETARY
J. H. Beesley	S. F. Bird
Baroid Sales Div.	Amerada Pet. Co.
Tulsa, Okla.	Tulsa, Okla.
Phone 28161	Phone 36251

Meets second Monday each month
(Study Group meets fourth Tuesday each month)
(Luncheon meetings each Thursday, Mayo Hotel)

NORTH TEXAS SECTION

Meeting City: Wichita Falls, Tex.

CHAIRMAN	SECRETARY
Rollie P. Dobyns	John H. Bolstad
U. S. Bureau of Mines	Continental Oil Co.
Wichita Falls, Tex.	Wichita Falls, Tex.

Meets second Monday each month

MISSISSIPPI SUB-SECTION

(of Delta Section)

Meeting Cities: Laurel, Jackson and Natchez, Miss.

CHAIRMAN	SECRETARY
John A. Rodgers	Paul Tsimortos
Gulf Refining Co.	Gulf Refining Co.
Lumberton, Miss.	Lumberton, Miss.
Phone 4501	Phone 4653

OKLAHOMA CITY SECTION

Meeting City: Oklahoma City, Okla.

CHAIRMAN	SECRETARY
L. F. Elkins	C. R. Miller
Sohio Petroleum Co.	Schlumberger
Oklahoma City	Oklahoma City
RE-90511	RE-91487

Meets third Thursday each month

PACIFIC PETROLEUM CHAPTER

Meeting City: Los Angeles, Calif.

CHAIRMAN	SECRETARY
F. L. Wadsworth	C. K. Ferguson
General Pet. Corp.	California Research
Los Angeles, Calif.	La Habra, Calif.
MA6-5711	OX7-1721

PERMIAN BASIN SECTION

Meeting Cities: Midland and Odessa

CHAIRMAN	SECRETARY
J. C. Blackwood	Maurice Lewis, Jr.
Amerada Pet. Corp.	British-American Oil
Midland, Tex.	Midland, Tex.
Phone 4-5533	Phone 4-8021

Meets third Monday each month

SAN JOAQUIN VALLEY GROUP

(of Pacific Petroleum Chapter)

Meeting City: Bakersfield, Calif.

CHAIRMAN	SECRETARY
R. P. Mangold	C. A. Davis
D. K. Partnerships	Richfield Oil Corp.
Bakersfield, Calif.	Bakersfield, Calif.
Bakersfield 32561	Maricopa 92631

Meets first Tuesday alternate months
(Feb., April, June, Aug., Oct., Dec.)

SOUTH PLAINS SECTION

Meeting City, Lubbock, Tex.

CHAIRMAN	SECRETARY
J. W. Brown	J. B. Livingston
Stanolind Oil & Gas	Haliburton Oil Well
Brownfield, Tex.	Cem. Co.
Phone 2166	Lubbock, Tex.
	Phone 5-5725

Meets third Thursday each month

SOUTHWEST TEXAS SECTION

Meeting City: Corpus Christi, Tex.

CHAIRMAN	SECRETARY
Ivan Tucker	Chester L. Wheless
Atlantic Ref. Co.	La Gloria Corp.
Corpus Christi, Tex.	Corpus Christi ,Tex
Phone 3-9372	Phone 3-8553

Meets third Wednesday each month
(No meetings July, August and December)

WEST CENTRAL TEXAS SECTION

Meeting City: Abilene, Tex.

CHAIRMAN	SECRETARY
J. L. Coulson	J. E. Russell
Warren Pet. Corp.	Reddin Oper. Comm.
Abilene, Tex.	Abilene, Tex.
Phone 4-8113	Phone 2-4031

Meets third Wednesday each month

WYOMING SECTION

Meeting City: Casper, Wyo.

CHAIRMAN	SECRETARY
R. D. Ferguson	W. R. Kahla
U. S. Geological Surv.	Ohio Oil Co.
Casper, Wyo.	Casper, Wyo.
Phone 3-4561	Phone 3-5721

Meets in alternate months
(No specific dates set)

AIME MEETING CALENDAR

Petroleum Branch Fall Meeting — Oct. 18-21, 1953, Baker and Adolphus Hotels, Dallas, Tex.; Oct. 17-20, 1954, San Antonio, Tex.

Pacific Petroleum Chapter Fall Meeting — Oct. 1-2, 1953, Ambassador Hotel, Los Angeles, Calif.

AIME Fall Meeting — Oct. 29-31, 1953, El Paso, Tex.

AIME Annual Meeting — Feb. 14-18, 1954, Statler Hotel, New York, N. Y.

Proposed for Membership, Petroleum Branch

Total AIME membership on Feb. 28, 1953, was 18,262; in addition 2,008 Student Associates were enrolled.

PETROLEUM BRANCH ADMISSIONS COMMITTEE

J. H. Sullivan, Chairman; Thomas S. Bacon, Vice-Chairman; A. E. Caraway, Frank C. Kelton, Thomas E. Morton and F. C. Prutzman.

INSTITUTE ADMISSIONS COMMITTEE

T. D. Jones, Chairman; Thomas G. Moore, Vice-Chairman; Harold S. Bell, F. W. Hanson, R. H. Chadwick, T. W. Nelson, J. H. Scaff, John T. Sherman, A. C. Brinker, Ivan Given, C. A. R. Lambly, G. P. Lutjen, E. A. Prentis and C. Leslie Rice, Jr.

The Institute desires to extend its privileges to every person to whom it can be of service, but does not desire as members persons who are unqualified. Institute members are urged to review this list as soon as possible and immediately to inform the Secretary's office if names of people are found who are known to be unqualified for AIME membership.

In the following list C/S means change of status; R, reinstatement; M, Member; J, Junior Member; A, Associate Member; S, Student Associate.

ARKANSAS

Magnolia — West, James Clyde (M).

CALIFORNIA

Fullerton — Warren, John Earl (J).
Santa Maria — Graves, Doyle Theodore (C/S-J-M).
Whittier — Goode, Ben H., Jr. (M).

COLORADO

Denver — Rossman, Charles Clayton (C/S-J-A).
Grand Junction — Ruhe, Karl (J).

ILLINOIS

Chicago — Reed, Kenneth Edward (A).

KANSAS

Russell — Arrendiell, Robert Warren (J); Everett, Tracey Carl (J).

LOUISIANA

Gretna — Lott, Clyde (A).
Harvey — Tillman, Cassius Ludwig, III (A).
New Iberia — Cain, Jack Lundy (M).
New Orleans — Francis, Byron L. (C/S-J-M); Kelly, Joseph Dyche (M).
Shreveport — Clinkenbeard, Paul S. (M).

MONTANA

Kalispell — Aronow, Willard Boris (R,C/S-J-M).

NEW MEXICO

Farmington — Egan, John Ambrose (M).

NEW YORK

New York — Herold, John Sublett (R,C/S-A-M); Stark, Mitchell (R,C/S-A-M); Wardlaw, Harold Wilberforce Roe (M); Westling, Randolph Eric (R,C/S-S-M).

OKLAHOMA

Drumright — Holden, John Chares (R,C/S-S-J).
Norman — Menzie, Donald E. (M).
Oklahoma City — Diehl, Ray Purdy (M); Smith, Shofner (C/S-J-M); Shelton, Howard Bucklin (M).
Ponca City — Guereca, Ross Antonio (J); Manering, Eldridge Leon (C/S-S-J).
Tulsa — Priestman, George Dawson (M).

PENNSYLVANIA

Mt. Pleasant — Coppula, Fiore W. (J).

TEXAS

Bellaire — Webster, Joe Townsen (M).
Brownfield — Hollingsworth, Frank Herman (C/S-S-J).
Corpus Christi — Ethridge, Lawrence Edward, Jr. (C/S-J-M); Patterson, Glenn Weldon (R, C/S-S-J).
Dallas — Lipstate, Philip H., Jr. (C/S-J-M); McGuire, William James (M); Shaw, Don J. (R,M); Wimberly, Chester Lee (A).
Denver City — McCasland, Leonard (J).
Dickinson — Wellborn, Joseph Haller (C/S-J-M).
Electra — Woodruff, Charles Carter (J).
Fort Worth — Hogan, Sam Wilson (M); Merkt, Ernest Edward, Jr. (C/S-J-M); Morgan, John Victor (C/S-J-M).
Goldsmith — Thacker, Jon Milton (J).
Houston — Angevine, Robert Harold (C/S-J A); Bartley, Arthur Newton (J); Furen, John Elmore (M); Shelton, John Elbert (R,C/S-S-J); Wadlington, Dewey Rudolph (J).
Jacksboro — Allen, Loy Fowler (C/S-S-J); Welch, Harlan E. (C/S-J-M).
Levelland — Crowl, Charles William (J).
Liberty — Straw, Henry Fenno (J).
Longview — Simon, Dick S. (R,C/S-S-M); Springer, Sam E. (J).
Midland — Wooldridge, Clarence Elliott (M).
Odessa — Cloughly, Ernest Marion (J); Wright, Lloyd C. (J).
Pharr — Hammett, Ellis Theodore (M).
Snyder — Rollins, James Thaydas (M).
Tyler — Bissell, Harry J. (J).
Whiteface — Gillham, James Augusta (J).
Wichita Falls — Eads, John Spruce (M); Hudson, Malcolm (M).

VIRGINIA

North Arlington — Stewart, Hugh Aloysius (R,M).

WYOMING

Grass Creek — Stewart, Joseph Edward (J).

BURMA

Moulmein — Nyun, Maling Thein (R,C/S-S-J).

LEBANON

Beirut — Heide, George Francis (C/S-J-M).

VENEZUELA

Jusepin — Caro, Ruben Alfredo (C/S-S-J). ★

HAVE YOU CHANGED YOUR ADDRESS?

In order that publications and correspondence may reach you promptly, the Petroleum Branch, AIME, should be advised as soon as possible of any change in your address, preferably a month before the change becomes effective. For the AIME directory and for the Personals column of the JOURNAL OF PETROLEUM TECHNOLOGY, additional information is desired. The form below is provided for your convenience, and should be sent to Petroleum Branch, AIME, 800 Fidelity Union Bldg., Dallas 1, Tex.

Name_____ Membership No._____

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Dues of New Members Now Prorated by Months

The Council of Section Delegates, at its meeting in February, 1951, recommended that consideration be given by the Board to billing new members on a pro-rata basis for the number of months remaining in the calendar year of election. The Board later approved this recommendation and the text of the necessary change in the bylaws to accomplish this was published in the April, 1952, issue of the JOURNAL OF PETROLEUM TECHNOLOGY. The plan was not immediately adopted because further study was required at Institute headquarters. This having been completed, and the practicality of the plan assured, the bylaw revision was voted by the Executive Committee at its meeting on March 18, 1953. The pertinent text of Art. II, Sec. 2, sentence 3 (see page xxxviii of the current Directory), is revised to read as follows: "Newly elected Members, Associate Members, or Junior Members shall, on receipt of Treasurer's statement, pay the current year's dues on a pro rata basis for the months remaining in the calendar year, including the month of election."

Henceforth, therefore, one month will be as good as another to join the AIME. If elected in June, for example, he would be billed for seven-twelfths of the annual dues, and would receive the journal of his choice for the rest of the year.

★ ★ ★

2,610 At Annual Meeting

Final figures for attendance at the Annual Meeting in Los Angeles, Feb. 16-19, 1953, were as follows: Members, 1,576; Student Associates, 78; Nonmembers, 301; Students, not SA's, 48; Unregistered men, 116; Ladies, members WAAIME, 336; Ladies, not members WAAIME, 155. Total attendance was 2,610. ★ ★ ★

Transactions Volumes Before 1949 Not Available

The AIME stock of petroleum Transactions volumes prior to Vol. 186 covering 1949 is now depleted. Transactions that are available are: Vol. 186 covering 1949, Vol. 189 covering 1950, Vol. 192 covering 1951, and Vol. 195 covering 1952.

Recently a survey of Petroleum Branch membership was made by the Branch office in Dallas to ascertain the demand for back volumes. At the meeting of the Petroleum Branch Executive Committee at the Annual Meeting in Los Angeles in February, it was determined that the demand was not sufficient at the present time to merit reprinting, and the question was tabled until next year when another measurement of the members' desire for these back issues could be made. Anyone wishing copies prior to 1949 might refer to local bookstores specializing in petroleum literature. ★ ★ ★

Smith Is President-Elect

Henry DeWitt Smith was named president-elect for 1954 by the Nominating Committee for AIME Officers in 1954, S. S. Clarke, chairman, which met in Los Angeles on Feb. 18. If elected, he will succeed L. F. Reinartz, who will serve as president in 1954. Other nominations of the committee were as follows: For vice-president, T. B. Counselman and Harold Decker; and for director, Ralph E. Kirk, Carleton C. Long, P. J. Shenon, George D. Dub, E. R. Marble, and E. C. Babson.

F. M. VAN TUYL, head of the department of geology at the Colorado School of Mines since 1919, will retire this summer with the rank of professor emeritus. His successor will be L. W. LeRoy, right, professor of geology and a member of the faculty since 1942.

Smith is vice-president of the Newmont Mining Corp., with headquarters in New York. He served as director of the Institute in 1941-42.

Brief biographical sketches of the nominees will be published in the July issues of the journals. No letter ballot will be mailed to members unless supplementary nominations are received by Sept. 1. ★ ★ ★

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Employment Notices

The JOURNAL will post notices of men and jobs available. Companies and AIME members are invited to use this space, for which there is no charge. Except as noted below, address replies to: Code (appropriate number), JOURNAL OF PETROLEUM TECHNOLOGY, 800 Fidelity Union Bldg., Dallas 1. Show return address on envelope. These replies will be forwarded unopened and no fees are involved.

Replies to the positions coded Y8455 and Y8509 below should be addressed to: Engineering Societies Personnel Service, 8 West 40th St., New York 18, N. Y. The ESPS, on whose behalf these notices are published here, collects a fee from applicants actually placed.

PERSONNEL

♦ Petroleum engineer, 29, married, one child, desires change of position. Graduate, University of Oklahoma, January, 1953. Currently completing district training program with major. Preference is production with active independent. All replies will be acknowledged. Code 191.

♦ Petroleum engineer, MS, 35, with 13 years' experience in all phases of petroleum engineering including pressure maintenance and water flooding. Now employed as chief reservoir engineer with major company. Desires supervisory position with smaller company, progressive independent or consulting firm. Code 192.

♦ Petroleum engineer, BS in petroleum engineering 1940, master's in business administration 1953. Seven years' experience in petroleum production, reservoir and evaluation engineering with major oil company and consulting firm. Four years U. S. Navy engineering officer. Interested in responsible position with active independent or consulting firm. Code 193.

POSITIONS

♦ The University of Tulsa has an opening for a qualified faculty member with master's degree or substantial experience. Reasonable salary and opportunity for consulting and research. Applicants contact A. W. Walker, Head of Petroleum Production Engineering Dept., The University of Tulsa, Tulsa 4, Okla.

♦ Junior geologist with degree, single status, for petroleum exploration. Must pass foreign service physical test, draft exempt. Salary, $4,700 a year plus subsistence and bonus. Location, Colombia or Venezuela. Y8455.

♦ Equipment specification engineers capable of writing specifications for all equipment used in all types of oil refineries, interpreting customer's specifications and checking supplier's prints. Prefer some experience in oil refinery work. Should have mechanical engineering degree but not essential. Location, Ohio. Y8509. ★ ★ ★

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Personals

EARL D. WALLACE, who recently resigned as president and director of Sohio Petroleum Co. and as a vice-president and director of The Standard Oil Co. (Ohio) has become a consultant on oil and gas matters to Dillon, Read & Co., Inc., New York, N. Y.

+

J. M. HANSELL, chief geologist, Rocky Mountain Division, Sun Oil Co., has returned to work in the Denver office following several months of sick leave.

+

WILLIAM P. BRYAN, formerly area engineer for Sun Oil Co. at Premont, Tex., has moved to Abilene where he is an independent oil operator.

+

MARION E. SPITLER, a January, 1953, graduate of Texas Western College in El Paso, Tex., has joined the El Paso Natural Gas Co. as a geologist. He is located in Jal, N. M.

+

JEAN D. HERRENSCHMIDT is now superintendent for the Societe Derecherches et D'Exploitations Petroliers en Alsace, located in Hautrhin, France. He was formerly a petroleum engineer for the Societe Nationale des Petroles du Languedoc Mediterraneen in Montpellier, France.

+

JOE R. CLARK has returned to the reservoir section of Stanolind Oil and Gas Co.'s division office in Fort Worth, Tex., after 20 months' military leave of absence.

+

A. MACLAY GARDNER has become export field engineer for Lane-Wells Co., and is assigned to the Conselho Nacional do Petroleo in Sao Paulo, Brazil. He was previously a division sales engineer for Lane-Wells in the Pacific division.

+

SIDNEY B. RICHARDS has been promoted to petroleum engineering supervisor in the general offices of Stanolind Oil and Gas Co. in Tulsa. He was formerly assistant division engineer of the Rocky Mountain division in Casper, Wyo.

WILLIAM K. WHITEFORD has been elected president of the Gulf Oil Corp. He was formerly executive vice-president. Beginning his career in the early 1920's as a field worker, Whiteford advanced from production engineer for Barnsdall Oil Co. to a vice-president and general managership. He has also been executive vice-president of British-American Oil Co. and executive vice-president, president and chairman of the parent company. In 1951, he joined the Gulf as a director and executive vice-president.

+

F. RAYMOND WHEELER, formerly chief engineer for Chemical and Geological Laboratories in Casper, Wyo., has become associated with J. E. Russell, petroleum engineering consultant of Abilene, Tex.

+

CHARLES E. PHILLIPS has recently joined Robert W. Harrison & Co. of Houston, Tex., as a petroleum reservoir engineer. For the past five years Phillips has been with Standard Oil Co. of Texas, serving as senior reservoir and reserves engineer. He is a graduate of Texas A&M College.

+

WALTER D. ROSE, engineering consultant in Houston, Tex., has been appointed senior research engineer for Continental Oil Co.'s development and research department at Ponca City, Okla. Associated with the oil industry for many years, Rose served with the Gulf Oil Corp. and Carter Oil Co. research staffs prior to becoming a consultant in Houston. He also has been an instructor at the University of Texas in Austin and a member of the editorial staff of the *Oil and Gas Journal*.

+

GUSTAV EGLOFF, director of research of Universal Oil Products Co., has been elected an honorary member of the Association Francaise des Techniciens du Petrole, Paris, France.

+

LYLE D. EBERLY has joined The Carter Oil Co. in Jasper, Ala., as a geologist.

G. FREDERICK SHEPHERD, formerly chief geologist for General American Oil Co. of Texas, has announced the establishment of a consulting firm to specialize in subsurface work. Well known for his geological work in Mid-Continent and Gulf Coast areas, he is author of many papers on various geological subjects, such as drilling time, South Louisiana development, geology of the Arick Field, and deep drilling. Offices will be located in the new Petroleum Services Building, now being completed at 3918 Hines Blvd., Dallas, Tex.

+

E. F. BULLARD, president of Stanolind Oil and Gas Co., Tulsa, was elected to the board of directors of the First National Bank and Trust Co., at the March board meeting. Bullard, president of Stanolind since 1945, has been a nationally known oil executive for many years. He started his career in 1921 as a geologist and joined the Dixie Oil Co. in 1949. Three years later he was made director-in-charge of exploration for Stanolind and was elected successively vice-president, director, executive vice-president and president of the company.

+

WILLIAM T. PRICE has become associated with the Manabi Exploration Co. in Guayaquil, Ecuador, as exploration geologist and assistant reservoir engineer. He was formerly a reservoir engineer with the Mene Grande Oil Co. at the San Tome Terminal, Venezuela.

+

R. E. KELLERMAN, formerly West Texas division engineer for Texas Crude Co. in Midland, has been transferred to Fort Worth as chief engineer.

+

A. J. GALLOWAY has been elected to the board of directors of Shell Oil Co. He is vice-president in charge of the company's exploration and production activities in the United States and Canada.

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The Petroleum Branch, AIME, headquarters wishes to purchase a set of the *reprinted* AIME Petroleum Transactions volumes. These volumes were reprinted in 1948, with one book containing two of the original transactions volumes as shown below. The price offered is $6.50 per book; the books needed are as follows:

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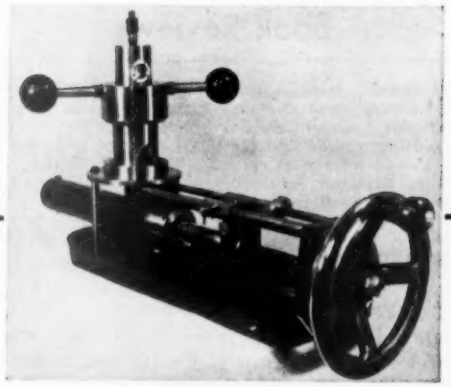

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Book Reviews

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Gasification and Liquefaction of Coal

A symposium, Institute of Mining and Metallurgical Engineers, New York, 1953. 221 pp. $6.00, $4.20 to AIME members.

For all fuels technologists, this book appeals as a composite of current world-wide status of the synthesis of liquid fuels from coal. The volume reflects new and current developments described by research men in operations dealing with improved techniques of gasification, plant design, direct hydrogenation, chemicals output, underground gasification, and gas economics.

Of the 15 papers contained in the symposium, seven describe new modifications of gasification processes; one reviews trends in the gasification of coal; two deal with hydrogenation, and five discuss the significance of successful coal gasification to American industry. Of the six gasification processes described (not including underground gasification) two use oxygen, two use air, one uses either, and one uses none — since the heat required for the reaction is supplied by external firing; three operate at atmospheric pressure, and three at elevated pressures; one gasifies the coal in a fixed bed, two in entrainment, two in a fluidized bed, and one in a fixed bed which is periodically fluidized to permit the clinker to drop to the grate. It is interesting to note that the new foreign processes described are primarily designed for atmospheric pressure operation.

Economics of Natural Gas in Texas

By John R. Stockton, Richard C. Henshaw, Jr., and Richard W. Graves. Bureau of Business Research (Research Monograph No. 15), University of Texas, Austin, 1952. 316 pp., 9½ x 6½ in., bound. $5.00.

A monographic study covering all the economic aspects of production and marketing in the natural gas industry with emphasis on the place of Texas in the overall national picture. The utilization of natural gas in the dry and liquid states, problems of production and reserves, and the more strictly economic questions of transportation and marketing, taxation, government control and conservation, and competition with other fuels are fully discussed, with a considerable amount of statistical data. Footnotes and bibliographies at the end of each chapter document all data, and 60 illustrations and 90 separate tabulations are included.

Petroleum Production Engineering (Oil Field Exploitation)

By Lester Charles Uren. McGraw-Hill Book Co., New York, 3rd edition, 1953. 807 pp., 9¼ x 6¼ in., bound. $10.00.

A detailed survey of the technology of oil production beginning with the completion of the field development phase and ending with the transportation of the products to market. It covers processes, methods, and equipment and the physical principles that control the recovery of petroleum from its reservoir rocks. This is one volume of a series of three, of which the other two cover oil field development and production economics. The selected lists of references accompanying each chapter have been revised along with the text to bring the whole book up to date. ★ ★ ★

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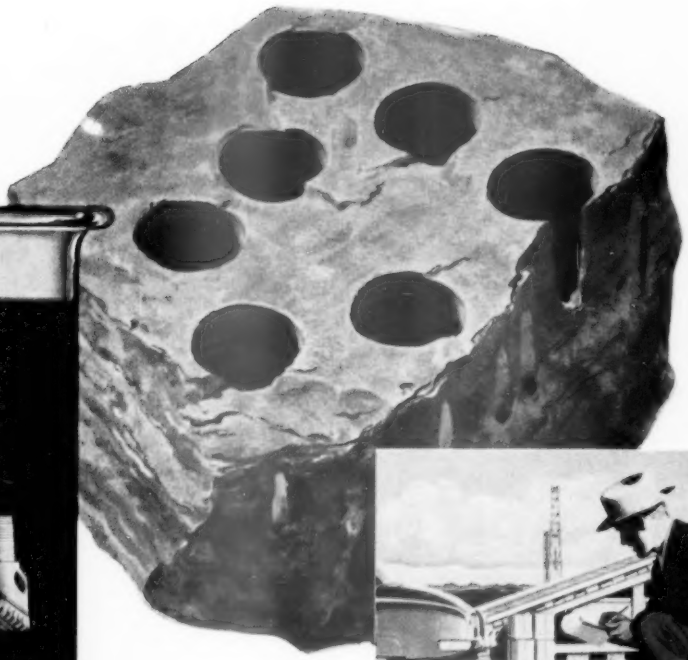

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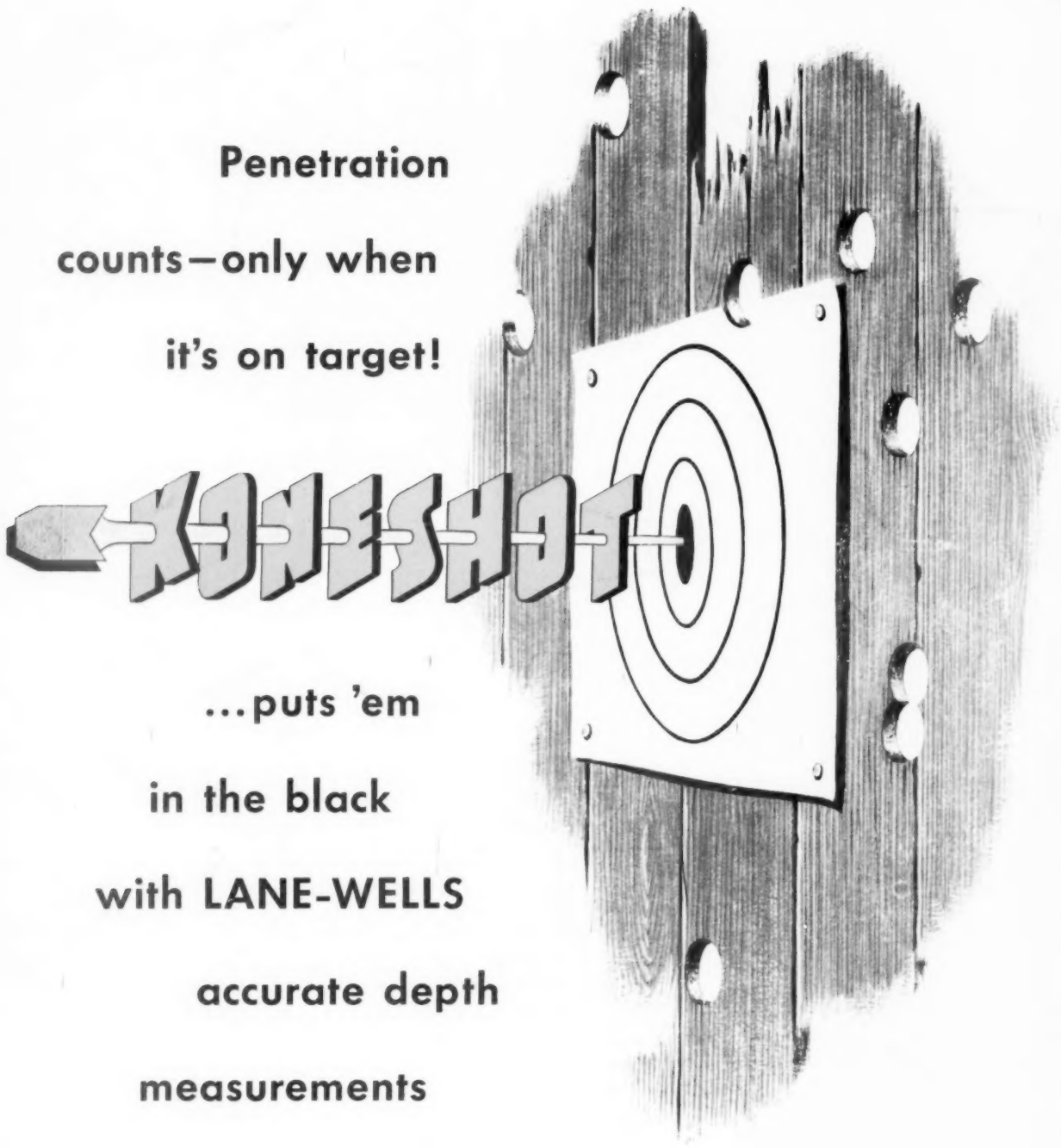

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